



Plant Invaders of Mid-Atlantic Natural Areas

**National Park Service
U.S. Fish and Wildlife Service**

Acknowledgements

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Funding generously provided by:

The National Fish and Wildlife Foundation

with matching contributions by:

Plant Conservation Alliance	The Nature Conservancy, MD–D.C. Chapter
Chesapeake Bay Foundation	Chesapeake Bay Trust
Maryland Department of Natural Resources	City of Bowie, Maryland
Worcester County (Maryland) Department of Comprehensive Planning	

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Plant Invaders of Mid-Atlantic Natural Areas

Introduction

All living things - bacteria, fungi, plants, animals and other organisms - have evolved to live in specific areas on the Earth. Local climate, geology, soils, available water and other natural factors influence which plants and animals live in particular ecosystems and habitats.

Natural areas are wild to semi-wild areas such as fields, forests, streams and wetlands, that are composed of diverse groups of native plants, animals and microorganisms. These biological groupings have evolved over thousands of years into natural communities and ecosystems. Large to small natural areas are all around us and include parks, refuges, preserves, fields, forests, open spaces, undeveloped areas on community and corporate lands, schoolyards, municipal facilities and backyard habitats.

What are native species?

A native species is one that occurs naturally in a particular place without human intervention. Species native to North America are generally recognized as those occurring on the continent prior to European settlement. Non-native plants are species that have been introduced to an area by people from other continents, states, ecosystems and habitats. Many non-native plants have great economic value for agriculture, forestry, horticulture and other industries and pose little to no threat to our natural ecosystems. Others have become invasive and pose a serious ecological threat.

What are invasive plants?

Invasive plants reproduce rapidly, spread over large areas of the landscape and have few, if any, natural controls, such as herbivores and diseases, to keep them in check. Many invasive plants share some important characteristics that allow them to grow out of control. These include: (1) spreading aggressively by runners or rhizomes; (2) producing large numbers of seeds that survive to germinate; and (3) dispersing seeds away from the parent plant through various means such as wind, water, wildlife and people.

How are invasive plants introduced?

People introduce exotic plants to new areas, on purpose and by accident, through a variety of means. Some species are introduced for use in gardening and landscaping, or for erosion control, forage and other purposes. For instance, in the 1930s, the Civilian Conservation Corps planted kudzu vine (introduced from Japan), throughout the Southeast to help stabilize soil in erodible areas.

Kudzu grew so prolifically that it was nicknamed the “vine that ate the South.” Others come in unknowingly, on various imported products or in soil, water and other materials used for ship ballast. Many invasive aquatic plants are introduced by dumping unwanted aquarium plants into waterways. Once established in a new environment, some exotic species proliferate and expand over large areas, becoming invasive pests.

How do invasive plants spread?

Invasive plants spread by seed, vegetative growth (producing new plants from rhizomes, shoots, tubers etc.) or both. Seeds, roots and other plant fragments are often dispersed by wind, water and wildlife. Animals spread invasive plants by consuming fruits and depositing seeds as well as transporting seeds on their feet and fur. People also help spread invasive plants by carrying seeds and other plant parts on shoes, clothing and equipment and using contaminated fill dirt and mulch. Invasive aquatic plants are often spread when plant parts attach to boat anchors and propellers.

Why are invasive plants a problem in natural areas?

Like an invading army, invasive plants are taking over and degrading natural ecosystems. Invasive plants disrupt the intricate web of life for plants, animals and microorganisms and compete for limited natural resources. Invasive plants impact nature in many ways including growing and spreading rapidly over large areas, displacing native plants, including some very rare species, reducing food and shelter for native wildlife, eliminating host plants of native insects and competing for native plant pollinators. Some invasives spread so rapidly that they muscle out most other plants, changing a forest, meadow, or wetland into a landscape dominated by one species. Such “monocultures” (stands of a single plant species) have little ecological value and greatly reduce the natural biological diversity of an area.

Invasive plants also affect the type of recreational activities that we can enjoy in natural areas such as boating, bird watching, fishing and exploring. Some invasives become so thick that it is impossible to access waterways, forests and other areas. Once established, invasive plants require enormous amounts of time, labor and money to control or eliminate. Invasive species cost the United States an estimated \$34.7 billion each year in control efforts and agricultural losses.

How to prevent spread of invasive plants

Become familiar with invasive plant species in your area. When selecting plants for landscaping, avoid using known invasive species and those exotic species exhibiting invasive qualities. A few common

ornamental plants that show invasive tendencies and that have become problematic elsewhere in the U.S. include: pampas grass (*Cortaderia selloana*); jubata grass (*Cortaderia jubata*); fountaingrass (*Pennisetum setaceum*); Chinese fountaingrass (*Pennisetum alopecuroides*); star-of-Bethlehem (*Ornithogalum umbellatum*); creeping lilyturf (*Liriope spicatum*) and water hyacinth (*Eichhornia crassipes*). Ask for native plant alternatives at your nursery. Obtain a list of plants native to your state from your native plant society, state natural resources agency, or the U.S. Fish and Wildlife Service, Chesapeake Bay Field Office (see references). Carry this list with you to nurseries to help with plant selection.

If you already have invasives planted on your property, consider removing them and replacing them with native species, such as those suggested in this guide. Refer to reputable resources (see references) for more information on identifying invasive plants and the best ways to control or remove a specific plant. When visiting a natural area, be alert for invasive species. If you see some, notify the agency or organization responsible for managing the land. Before you leave, avoid carrying “hitchhiking” plant material by taking time to brush seeds from clothing and shoes and remove plant material from boats, trailers and other items.

Information about this guide

This illustrated handbook describes a variety of highly invasive plants impacting the region’s natural areas. It provides identification tips, a few suggested native plant alternatives and some control information for a variety of invasive aquatic and terrestrial species in the mid-Atlantic region.

For purposes of this manual, the mid-Atlantic region includes the District of Columbia and the states of Delaware, Maryland, New Jersey, Pennsylvania, Virginia and West Virginia. More than 200 exotic plant species have been identified by natural resource managers as problematic invaders of natural areas in the mid-Atlantic region. The plants included in this guide are some of the most problematic invasives that are responsible for significant degradation of natural communities in this region. This guide is not intended to be a complete resource on invasive plants in the mid-Atlantic region and a list of organizations is provided where readers can obtain additional information. Plants excluded from this guide should not be assumed to be environmentally safe.

For more complete information on invasive plants, including species not covered in this guide, contact the Mid-Atlantic Exotic Pest Plant Council at <http://www.ma-eppc.org> or the Plant Conservation Alliance, Alien Plant Working Group at www.nps.gov/plants/alien/.

Aquatic Plants

Eurasian Watermilfoil

Myriophyllum spicatum

Origin: Eurasia and Africa

Background

Introduced accidentally from Eurasia in the 1940s,

Eurasian milfoil possibly escaped from an aquarium or was brought in on a commercial or private boat.

Mike Naylor, MD DNR



Distribution and Ecological Threat

Eurasian watermilfoil occurs in at least 33 states east of the Mississippi River and has recently been found in Colorado. It is abundant in the Chesapeake Bay, the tidal Potomac River and several Tennessee Valley reservoirs. Typical habitat includes fresh to brackish water of ponds, lakes, slow-moving streams, reservoirs, estuaries and canals. Eurasian watermilfoil is tolerant of many water pollutants, tends to invade disturbed areas where native plants are less able to re-grow and does not typically spread into undisturbed areas where native plants are well established. It can form large, floating mats of vegetation on the surface of lakes, rivers and other water bodies, preventing light penetration for native aquatic plants and impeding water traffic. The plant thrives in areas that have been subjected to various kinds of natural and manmade disturbance.

Description and Biology

- Plant: an herbaceous aquatic plant in the water-milfoil family (Haloragaceae); stems grow to the water surface, usually extending 3 to 10 feet but as much as 33 feet in length and frequently forming dense mats; stems are long, slender, branching, hairless and become leafless toward the base; new plants may emerge from each node (joint) on a stem and root upon contact with mud.
- Leaves: bright green leaves are finely divided and occur in whorls of three or four along the stem, with 12 to 16 pairs of fine, thin leaflets about 1/2 inch long. These leaflets give milfoil a feathery appearance that is a distinguishing feature of the plant.
- Flowers, fruits and seeds: Eurasian watermilfoil produces small, yellow, four-parted flowers on a spike that projects 2 to 4 inches

above the water surface. Flower spikes often remain above water until pollination is complete. The fruit is a hard, segmented capsule containing four seeds.

- Spreads: by rhizomes, fragmented stems and axillary buds that develop throughout the year. Although seeds are usually viable, they are not an important means of dispersal.
- Look-alikes: hydrilla (*Hydrilla verticillata*), other species of *Myriophyllum* and *Elodea*

Prevention and Control

Large harvesting equipment can be used to mechanically remove milfoil in larger areas; a sturdy hand-rake can be used for smaller areas. Other options include manipulation of water level, use of water colorants or floating aquatic plants to reduce light penetration, physical barriers and chemical control. Potential impacts to existing native aquatic plant species should be evaluated carefully before implementing any of these techniques.

Native Alternatives

Some aquatic nurseries carry native and non-invasive alternatives. However, due to the similarity in appearance among aquatic plants to the untrained eye, they are easily confused. Contact your state natural resource agency, native plant society or other resource (see reference section) for assistance in locating species appropriate to your location and site conditions.

All photos this page by Mike Naylor, MD DNR



Aquatic Plants

Giant Salvinia

Salvinia molesta

Origin: South America

Background

Giant salvinia, also known as water fern or kariba-weed, was introduced as an ornamental aquatic plant and is spread to new water bodies on boats and fishing gear, by dumping of aquaria, and by other unintentional means. Sale, transport, release and other activities with this plant are prohibited in the United States by Federal law.



C. Jacono, USGS

Distribution and Ecological Threat

Giant salvinia has populations scattered throughout the Southeastern U.S. from eastern Texas through eastern North Carolina. There are two known occurrences in the tip of Southern California. In the summer of 2000, a small population was discovered in aquatic ornamental ponds in Washington, D.C., and was quickly eradicated. It poses a serious threat to lakes, ponds, streams, rivers and other freshwater wetlands, and cultivated rice fields. Giant salvinia grows rapidly and spreads across water surfaces, forming dense floating mats that cut off light to other aquatic plants, reduce oxygen content and degrade water quality for fish and other aquatic organisms.

Description and Biology

- Plant: a floating aquatic fern with leaves that become compressed into chains in older plants.
- Leaves: about 1/2 to 1 1/2 inches long; oval, folded, and covered with arching hairs that appear like "beaters" on upper leaf surfaces.
- Flowers, fruits and seeds: reproduces and spreads by tiny spores (rather than flowers)
- Spreads: by transport of plant fragments by water, humans and wildlife.

- Look-alikes: Common salvinia (*Salvinia minima*), a native plant, looks very similar, but its leaf hairs do not join at the tip to form “beaters” as in giant salvinia.

Prevention and Control

Do not buy this plant or release it into the wild (these activities are prohibited by U.S. law). If you think you see this plant, call 1-877-STOP ANS to report it. If you have this plant and no longer want it, pile plants onto a dry sunny surface (e.g., driveway) and let them dry out completely. Once completely dry, bag them in a sturdy plastic trash bag and dispose of in a landfill. Contact proper authorities about other methods of control and disposal.

Native Alternatives

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C. Jacono, USGS



R. Bourke, USGS

Aquatic Plants

Hydrilla

Hydrilla verticillata

Origin: Central Africa

Background

Hydrilla first appeared in the Crystal River system of Florida in 1960. Imported by the aquarium trade, its presence on the Delmarva Peninsula was confirmed in 1981. Hydrilla attracted national attention when infestations were found in the Potomac River in Washington, D.C. in the early 1980s.



Mike Naylor, MD DNR

Distribution and Ecological Threat

Hydrilla is a federal noxious weed that is documented throughout the southern United States from California to Delaware. In the mid-Atlantic, hydrilla now exists in most southern Delaware ponds, in the Delaware portion of the Nanticoke River, in Virginia and Maryland freshwater tributaries of the Chesapeake Bay, and several sites in eastern Pennsylvania. Hydrilla out-competes native submerged aquatic vegetation and can quickly fill a pond or lake, thus choking off the water body for boating, fishing, swimming and other recreational uses. It does provide good habitat for fish and shellfish as well as water quality benefits.

Description and Biology

- Plant: rooted aquatic plant; a member of the frogbit family (Hydrocharitaceae).
- Leaves: up to 3/4 inch long; usually in whorls of five oblong leaves on the stems; fine teeth visible to the naked eye on leaf edges and mid-ribs.
- Flowers, fruits and seeds: tiny, translucent to white flowers produced on the upper branches in late summer and fall; tubers grow from the roots; winter buds (turions) are produced in the leaf axils.
- Spreads: vegetatively through fragments of stems, stolons, or rhizomes, turions, or tubers which are carried on boat livewells, motors and trailers, bait pails and other items, and by ingestion of tubers and turions by waterfowl.

- Look-alikes: common waterweed (*Elodea canadensis*), Nuttall's waterweed (*E. nuttallii*), Eurasian watermilfoil (*Myriophyllum spicatum*) and other aquatic plants with whorled leaves.

Note: Most elodeas and watermilfoil species have smooth leaf margins and leaves in whorls of three.

Prevention and Control

Physical, chemical and biological controls have all been used on hydrilla. Each control method has advantages and liabilities. Water level drawdowns have generally been ineffective in our area. Mechanical aquatic weed harvesters provide temporary relief and open boating lanes, but resulting plant fragments can help spread the vegetation faster. Contact herbicides provide temporary control, but systemic herbicides provide more long-term control. Herbivorous fish such as sterile grass carp have been used for hydrilla control where allowed by law. Other biological controls are still being investigated. Each control method has its drawbacks and liabilities. On the Potomac River and other parts of the Chesapeake Bay system, resource managers who are struggling with hydrilla also recognize the beneficial impacts of submerged aquatic vegetation (including hydrilla) for water quality and fish and shellfish habitat.

Native Alternatives

Some aquatic nurseries carry native and non-invasive alternatives. However, due to the similarity in appearance among aquatic plants to the untrained eye, they are easily confused. Contact your state natural resource agency, native plant society or other resource (see reference section) for assistance in locating species appropriate to your location and site conditions.



Mike Naylor, MD DNR



Mike Naylor, MD DNR

Aquatic Plants

Parrot Feather Watermilfoil

Myriophyllum aquaticum

Origin: South America

Background

Parrotfeather was introduced to the United States in the Washington, DC area about 1890. Commonly sold for aquaria and aquatic gardens, it has escaped to some freshwater ponds in this region.



Mike Naylor, MD DNR

Distribution and Ecological Threat

Parrotfeather occurs in at least 26 states throughout the United States, and is limited to non-tidal fresh waters. It can form dense mats and compete with native aquatic plants, especially in shallow ponds. It also provides habitat for mosquito larvae, impedes boats and clogs drainage ditches.

Description and Biology

- Plant: aquatic plant with stout stems; both stems and submerged leaves may be reddish tinted; gray-green tips of the stems with leaves may protrude above the water.
- Leaves: are finely divided, pale whitish green in color, in whorls of mostly five with smooth leaf margins.
- Flowers, fruits and seeds: flowers in axils of submerged leaves; fruits up to 1/8 inch long.
- Spreads: vegetatively from whole plants or fragments; it can be dispersed by people dumping aquaria into rivers and ponds and by animals carrying fruits and fragments on their bodies.
- Look-alikes: coontail (*Ceratophyllum demersum*), hydrilla (*Hydrilla verticillata*), Eurasian watermilfoil (*Myriophyllum spicatum*, non-native, invasive), and possibly elodeas.

Prevention and Control

Attempting control by manual or mechanical means tends to spread the plants and should only be conducted in small, contained water

bodies. Draining a pond in the summer achieved control in one instance, but draining may not achieve control in winter. Control with herbicides is difficult because the emergent stems and leaves have a waxy cuticle that repels herbicides. Research into biological control of parrotfeather is ongoing.

Native Alternatives

Some aquatic nurseries carry native and non-invasive alternatives. However, due to the similarity in appearance among aquatic plants to the untrained eye, they are easily confused. Contact your state natural resource agency, native plant society or other resource (see reference section) for assistance in locating species appropriate to your location and site conditions.



All photographs on this page by Peter Bergstrom, USFWS

Aquatic Plants

Water Chestnut

Trapa natans

Origin: Europe, Asia and Africa

Background

Water chestnut was first observed in North America near Concord, Massachusetts in 1859. The exact path for the introduction is unknown.



Mike Naylor, MD DNR

Distribution and Ecological Threat

Water chestnut can grow in any freshwater setting, from intertidal waters to 12 feet deep, although it prefers nutrient-rich lakes and rivers. Presently, the plant is found in Maryland, Massachusetts, New York and Pennsylvania, with most problematic populations occurring in the Connecticut River valley, Lake Champlain region, Hudson River, Potomac River and the upper Delaware River. Water chestnut can form dense floating mats, severely limiting light – a critical element of aquatic ecosystems. This plant can also reduce oxygen levels, which may increase the potential for fish kills. It competes with native vegetation and is of little value to waterfowl. Water chestnut infestations limit boating, fishing, swimming and other recreational activities. Further, its sharp fruits, if stepped on, can cause painful wounds. Water chestnut has been declared a noxious weed in Arizona, Massachusetts, North Carolina and South Carolina. Its sale is prohibited in most southern states.

Description and Biology

- Plant: an annual aquatic plant with a submerged stem; stems can reach 12 to 15 feet in length; very fine roots anchor the plant into the mud.
- Leaves: at the water's surface, the plant contains a rosette of floating leaves. The saw-tooth edged leaves are triangular in shape and connect to an inflated petiole, which provides added buoyancy for the leafy portion; additional, feather-like leaves can be found along the submerged stem.
- Flowers, fruits and seeds: four-petaled white flowers form in June and are insect-pollinated. The fruit is a nut with four 1/2-inch,

barbed spines. Seeds can remain viable for up to 12 years, although most will germinate within the first two years.

- Spreads: by the rosette and fruits detaching from the stem and floating to another area on currents or by fruits clinging to objects, birds and other animals.

Prevention and Control

Specialized methods of control are required to handle water chestnut infestations. Because of the likelihood of unintentional spread offsite and injury to those attempting control, only trained and certified persons should undertake management. Manual, mechanical and chemical techniques are used in its control.

Complete removal of plants is imperative, as floating, uplifted plants and plant parts can spread the plant to new locations. It is critical that any removal take place prior to the July seed set. Eradication is difficult because water chestnut seeds may lay dormant for up to 12 years. Biological controls are being investigated, but no species have been approved for release.

Native Alternatives

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Mike Naylor, MD DNR



Herbaceous Plants

Garlic Mustard

Alliaria petiolata

Origin: Europe

Background

Garlic mustard was first recorded in the United States around 1868, from Long Island, New York, and was likely introduced by settlers for food and medicinal purposes.



Britt Slaterry, USFWS

Distribution and Ecological Threat

Garlic mustard ranges from eastern Canada, south to Georgia and as far west as Kansas and Nebraska. It occurs in a wide range of moist to dry habitats including roadsides, floodplains, and forest edges and interiors and does not tolerate highly acidic soils. Garlic mustard invades areas disturbed by human activities and appears to be aided by white-tailed deer that prefer to eat native wildflowers and leave garlic mustard



Britt Slaterry, USFWS

untouched. Garlic mustard displaces many native spring wildflowers such as spring beauty (*Claytonia virginica*), wild ginger (*Asarum canadense*), bloodroot (*Sanguinaria canadensis*), Dutchman's breeches (*Dicentra canadensis*), toothworts (*Dentaria* species) and trilliums (*Trillium* species) that occur in the same habitat. It is also credited with the decline of the West Virginia white butterfly (*Pieris virginiensis*) because chemicals in garlic mustard appear to be toxic to the butterfly's eggs.

Description and Biology

- Plant: a biennial herb in the mustard family (Brassicaceae); completes its life cycle within two years and dies back by the second June, when it is recognizable only by its dried fruiting stalks; flowering plants range from 1 to nearly 4 feet in height.
- Leaves: crushed leaves and stems have a garlic-like odor; first-year plants appear as a rosette of kidney-shaped leaves that stay green throughout the winter; in its second year, the plant forms a shoot which rapidly elongates and flowers in early spring.
- Flowers, fruits and seeds: clusters of small white flowers in the axils of leaves along the stem; each flower has four petals in the

shape of a cross; fruits are slender, erect capsules that contain a row of shiny black seeds when mature.

- Spreads: a single plant can produce hundreds of seeds, which are scattered up to several yards from the parent plant.
- Look-alikes: toothworts (*Dentaria* species), sweet cicely (*Osmorhiza claytonii*), wild anise (*Osmorhiza longistylis*) and early saxifrage (*Saxifraga virginensis*).

Prevention and Control

Because garlic mustard seeds can survive for five or more years in the soil, effective management of garlic mustard requires a long-term commitment. Hand removal of entire plants, including the roots, is effective for light, scattered infestations. Cutting flowering plants low to the ground in spring will prevent flowering and thus seed production. Careful hand removal and bagging of plants with mature fruits can be done from June through August. Several herbicides are also effective for its control. Researchers are investigating the potential for biological control of garlic mustard.

Native Alternatives

Once garlic mustard has been removed, re-establish native groundcovers such as:

wild ginger
(*Asarum canadense*)



Britt Slattery, USFWS

lady fern
(*Athyrium filix-femina*)



Kenneth J. Sytsma, UWI

evergreen wood fern
(*Dryopteris marginalis* or *intermedia*)



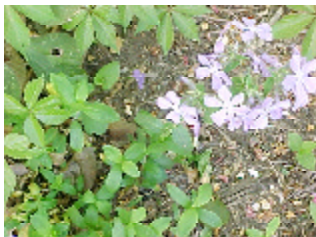
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foam flower
(*Tiarella cordifolia*)



Britt Slattery, USFWS

creeping phlox
(*Phlox stolonifera*)



Britt Slattery, USFWS

New York fern
(*Thelypteris noveboracensis*)



Britt Slattery, USFWS

Herbaceous Plants

Japanese Knotweed

Polygonum cuspidatum

Origin: Eastern Asia

Background

Japanese knotweed was probably introduced into the United States in the late 1800's. It was first planted as an ornamental and has also been used for erosion control and landscape screening. Japanese knotweed is a noxious weed in the state of Washington.



Britt Slattery, USFWS

Distribution and Ecological Threat

Japanese knotweed occurs across the continent from Maine to Wisconsin, south to Louisiana and in scattered locations in the Midwest and Western states. It can tolerate a variety of adverse conditions, including deep shade, high temperatures, high salinity and drought. Knotweed is commonly found near water sources, such as along streams and rivers, in low-lying areas, waste places and utility rights-of-way and around old home sites. It spreads quickly to form dense thickets that exclude native vegetation and greatly alter natural ecosystems. Japanese knotweed poses a significant threat to riparian areas, where it can survive severe floods and rapidly colonize scoured shores and islands. Once established, populations are extremely persistent.

Description and Biology

- **Plant:** a member of the buckwheat family (Polygonaceae), knotweed is an upright, shrubby, herbaceous perennial that can grow to over 10 feet in height. Stems of Japanese knotweed are smooth, stout and swollen where the leaf meets the stem. Like all members of the family, it has a membranous sheath surrounding the joints of the stem.
- **Leaves:** although variable, leaves are normally about 6 inches long by 3 to 4 inches wide, broadly oval to somewhat triangular and pointed at the tip.
- **Flowers, fruits and seeds:** minute greenish-white flowers occur in attractive, branched sprays in summer and are followed soon after by small winged fruits. Seeds are triangular, shiny and very small, about 1/10 inch long.

- Spreads: primarily by seed and by vegetative means with the help of long, stout rhizomes. It can be transported to new sites by water, wind, as a contaminant in fill-dirt, or on the soles of shoes. It often escapes from neglected gardens and discarded cuttings.
- Look-alikes: Virginia knotweed (*Tovara virginica*), prince's feather (*Polygonum orientale*), and giant knotweed (*Polygonum sachalinense*, non-native).

Prevention and Control

Japanese knotweed is an extremely difficult plant to control due to its ability to re-grow from vegetative pieces and from seeds. Mechanical and chemical methods are most commonly used to eliminate it. Single young plants can be pulled by hand depending on soil conditions and root development. All roots and runners must be removed to prevent re-sprouting. Glyphosate and triclopyr herbicides have been used, applied either to freshly cut stems or to foliage.

Native Alternatives

sweet pepperbush
(*Clethra alnifolia*)



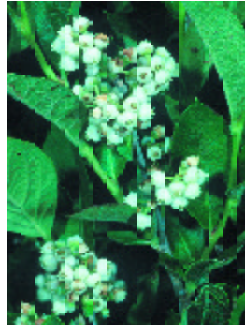
USFWS

Virginia sweetspire
(*Itea virginica*)



Britt Slattery, USFWS

maleberry
(*Lyonia ligustrina*)



R. Harrison Wiegand

fragrant or shining sumac
(*Rhus aromatica* or *copallina*)



R. Harrison Wiegand

silky dogwood
(*Cornus amomum*)



Chris Miller, NRCS

Herbaceous Plants

Japanese Stilt Grass

Microstegium vimineum

Origin: Japan, Korea, China, Malaysia and India

Background

Japanese stilt grass was first introduced into the United States in Tennessee around 1919 and likely escaped as a result of its use as a packing material for porcelain.



Ted Bodner

Distribution and Ecological Threat

Japanese stilt grass is currently established in 16 eastern states, from New York to Florida. It occurs on stream banks, river bluffs, floodplains, emergent and forested wetlands, moist woodlands, early successional fields, uplands, thickets, roadside ditches, gas and power-line corridors, lawns and gardens. Japanese stilt grass threatens native understory vegetation in full sun to deep shade. Stilt grass readily invades disturbed shaded areas, like floodplains that are prone to natural scouring, and areas subject to mowing, tilling and other soil-disturbing activities including white-tailed deer traffic. It spreads opportunistically following disturbance to form dense patches, displacing native wetland and forest vegetation as the patch expands. Japanese stilt grass appears to be associated with moist, acidic to neutral soils that are high in nitrogen.

Description and Biology

- Plant: an annual in the grass family (Poaceae) resembling a small, delicate bamboo; mature plants are 2 to 3 feet in height.
- Leaves: pale green, lance-shaped, asymmetrical, about 3 inches in length, with a shiny midrib.
- Flowers, fruits and seeds: delicate spikes of flowers emerge from slender tips in late summer and early fall. Fruits are produced shortly after flowering and then the entire plant dies.
- Spreads: vegetatively by rooting at joints along the stem (a new plant can emerge from each node) and by seed. A single plant can produce 100 to 1,000 seeds that remain viable in the soil for at least three years, ensuring its persistence. Stilt grass seed germi-

nates readily following soil disturbance. Although dispersal is not fully understood, seeds are probably transported by movement of water (e.g. surface runoff, streams, and floodwaters), soil, plants and on the feet of animals including people.

- Look-alikes: Virginia cutgrass (*Leersia virginica*), Pennsylvania knotweed (*Polygonum persicaria*), and other delicate grasses.

Prevention and Control

Because it is similar in appearance to several native grasses, it is important to know how to recognize and differentiate stilt grass from look-alikes. The shiny midrib and asymmetrical leaves help to distinguish stilt grass. Early attention to new infestations should be a priority. Because it is shallow-rooted, stilt grass may be pulled by hand at any time. Flowering plants can be cut back using a mower or weed whip prior to seed production. For extensive infestations, contact and systemic herbicides may be more practical and effective.

Native Alternatives

Following disturbance to an area susceptible to stiltgrass, stabilize with native vegetation suitable to site conditions. Refer to References on pages 76-78.



James H. Miller

Herbaceous Plants

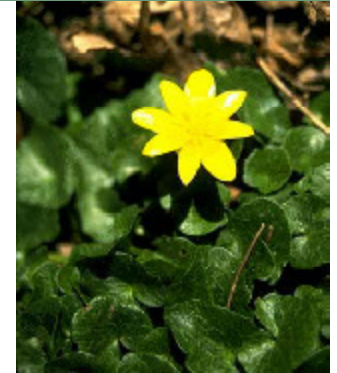
Lesser Celandine

Ranunculus ficaria

Origin: Europe

Background

Lesser celandine, also known as fig buttercup, was introduced to the United States as an ornamental plant and many colorful varieties are currently available commercially.



Jill Swearingen, NPS

Distribution and Ecological Threat

Lesser celandine is currently found in 20 northeastern states and in Oregon, Washington and several Canadian provinces. It occurs most commonly on moist, forested floodplains areas. The greatest impact of lesser celandine is on native spring-flowering plants. Lesser celandine emerges in advance of most native spring species, giving it a great competitive advantage. Once established, it spreads rapidly across the forest floor to form a blanket of leaves which native species are unable to penetrate.

Description and Biology

- Plant: perennial herbaceous plant in the buttercup family (Ranunculaceae).
- Leaves: shiny, dark green, kidney-shaped, stalked leaves may appear as early as January.
- Flowers, fruits and seeds: glossy, butter-yellow flowers appear in March and April supported on delicate stalks above the leaves. Aboveground portions of lesser celandine die back by early June.
- Spreads: primarily by bulblets and underground tubers. The tiny cream-colored bulblets are attached to leafstalks and are easily dislodged from the plant. A mass of small, gray, fingerlike tuberous roots underlies each plant. Bulblets and tubers are easily carried downstream during flood events and may be unearthed and scattered by the digging activities of some animals.
- Look-alikes: native marsh marigold (*Caltha palustris*), several native buttercups.

Prevention and Control

Care should be taken to correctly identify lesser celandine before undertaking any control efforts to avoid removing native look-alike plants. For small infestations, clumps of lesser celandine can be pulled by hand or dug up using a shovel, removing entire plants and as many tubers as possible. Use of contact or systemic herbicides is also an option but should be done as early as possible to avoid impact to native plant species.

Native Alternatives

wild ginger
(*Asarum canadense*)



Britt Slattery, USFWS

wild geranium
(*Geranium maculatum*)



Britt Slattery, USFWS

green and gold
(*Chrysogonum virginianum*)



Britt Slattery, USFWS

foam flower
(*Tiarella cordifolia*)



Britt Slattery, USFWS

Herbaceous Plants

Purple Loosestrife

Lythrum salicaria

Origin: Eurasia

Background

Purple loosestrife was introduced to the northeastern United States and Canada in the 1800s for ornamental and medicinal uses. It is still widely sold as an ornamental, except in states such as Minnesota, Wisconsin and Illinois where regulations now prohibit its sale, purchase and distribution. Purple loosestrife adapts readily to natural and disturbed wetlands.



Britt Slattery, USFWS

Distribution and Ecological Threat

According to the U.S. Fish and Wildlife Service, purple loosestrife now occurs in every state except Florida. Purple loosestrife is capable of invading many wetlands, including wet freshwater meadows, tidal and non-tidal marshes, river and stream banks, pond edges, reservoirs and ditches. Under favorable conditions, loosestrife is able to rapidly establish and replace native vegetation with a dense, homogeneous stand that reduces local biodiversity, endangers rare species and provides little value to wildlife.

Description and Biology

- Plant: erect perennial herb in the loosestrife family (Lythraceae); have a square, woody stem usually covered by downy hair; grow from 4 to 10 feet high, depending upon conditions.
- Leaves: lance-shaped, stalk-less and rounded to heart-shaped at the base; arranged in pairs or whorls around the stem.
- Flowers, fruits and seeds: produces a showy display of magenta-colored flower spikes throughout much of the summer. Individual flowers have five to seven petals. A single mature plant can have 30 to 50 stems arising from one rootstock, and can produce an estimated two to three million seeds per year. The flowering season extends from June to September; flowers require pollination by insects, for which they supply an abundant source of nectar.

- Spreads: through the vast quantity of seeds, dispersed by wind and water. It also readily reproduces vegetatively through underground stems at a rate of about one foot per year.

Prevention and Control

Small infestations of young purple loosestrife plants may be pulled by hand, preferably before seed set. For older plants, spot treatment with a glyphosate type herbicide (Rodeo® for wetlands or near water, Roundup® for uplands) may be effective. Biological control, using several imported beetle species approved by the USDA for release, is the most effective method for long-term control of large infestations. Although these beetles occasionally feed on native plant species, their potential impact to non-target plants is considered to be minimal.

Native Alternatives

Joe Pye weed
(*Eupatorium fistulosum*)



Chris Miller, NRCS

cardinal flower
(*Lobelia cardinalis*)



USFWS

New York ironweed
(*Vernonia noveboracensis*)



Britt Slattery, USFWS

blazing star or gayfeather
(*Liatris spicata*)



Randy Loftus, USFWS

obedient plant
(*Physostegia virginiana*)



Britt Slattery, USFWS

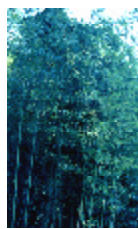
blue vervain
(*Verbena hastata*)



R. Harrison Wiegand

Exotic Bamboos

Bambusa, Phyllostachys and Pseudosasa species



Britt Slattery, USFWS

Several kinds of exotic invasive bamboos have been introduced from various countries (Asia, Latin America and the Caribbean) primarily for use as ornamentals and for privacy fences. Many are vigorous growing plants that quickly spread beyond their original planting site through underground stems (rhizomes) and resprouting from cut stems. Planting exotic bamboos should be avoided or measures taken to prevent spread (e.g., containerizing planting with underground barriers). A native bamboo – giant cane (*Arundinaria gigantea*) – occurs in the southeastern states up to southern Maryland and should not be confused with the exotic invaders.

Prevention and Control

Be sure to correctly identify plants before removing. Most bamboos are easily controlled by combining cutting to the ground in June with a fall application of glyphosate to any re-growth, and a repeat application two weeks later.

Native Alternatives

big bluestem (*Andropogon gerardii*), bottlebrush grass (*Elymus hystrix*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*)

Canada Thistle

Cirsium arvense



Britt Slattery, USFWS

Canada thistle, a perennial member of the aster family and a native of temperate regions of Eurasia, was introduced to the United States during the 1600s and is designated as a noxious weed in 43 states. It invades a variety of dry to moist habitats including barrens, fields, glades, pastures, stream banks, wet meadows and wet prairies. Canada thistle displaces native plants, changes the structure and species composition of natural plant communities and reduces biodiversity. Abundant seeds germinate within a year, but seeds remain viable for at least 20 years. It also spreads vegetatively, through lateral roots and root fragments.

Prevention and Control

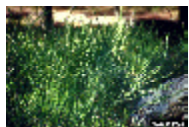
Many native species of thistle occur in the United States, including some that are very rare. Positive identification of Canada thistle should be made before any control is attempted. Management includes long-term hand-cutting, mowing, controlled burning or chemical means, depending on the level of infestation and the type of area being managed.

Native Alternatives

After eradicating, plant area with native vegetation appropriate to site conditions. Refer to References on pages 76-78.

Chinese Lespedeza

Lespedeza cuneata



Jil Swearingen, NPS

Chinese lespedeza was introduced from Asia by federal and state agencies for use in bank stabilization, soil improvement, wildlife forage, hay and other purposes. It has become established throughout the U.S. and invades a wide variety of habitats including fields, prairies, pond borders, swamps, meadows, open woodlands and disturbed grounds. Once established, it out-competes native plants and develops an extensive seed bank in the soil. Lespedeza's high tannin content makes it unpalatable to native wildlife and livestock. It spreads by seed.

Prevention and Control

Hand pulling is impractical due to lespedeza's extensive perennial root system. Mowing plants in the flower stage for two or three consecutive years may control spread. Plants should be cut as low as possible. Several herbicides are labeled for use on Chinese lespedeza and are effective when used in early to mid summer.



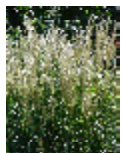
James H. Miller

Native Alternatives

blue or yellow wild indigo (*Baptisia australis* or *tinctoria*), partridge pea (*Cassia fasciculata*), Virginia wild rye (*Elymus virginicus*), little bluestem (*Schizachyrium scoparium*), wild senna (*Senna hebecarpa* or *marilandica*)

Chinese Silver Grass

Miscanthus sinensis



B. Slattery

Chinese silver grass was introduced from Asia about a century ago for use as an ornamental plant. It is a showy grass that readily spreads in areas where the soil is disturbed, such as roadsides, forest edges and clearings, and can create a thicket that prevents the growth of other plants. Because it is highly flammable, Chinese silver grass can be a fire hazard. It spreads by wind-dispersed seed and locally through growth of rhizomes.

Prevention and Control

Pull seedlings and shallow-rooted plants. Dig out larger plants, including the root systems. Re-sprouting will occur if entire root system is not removed. Cutting may spread plant into clean areas. The best control is through application of glyphosate herbicide in the fall or late spring.

Native Alternatives

big bluestem (*Andropogon gerardii*), bushy beardgrass (*Andropogon glomeratus*), bottlebrush grass (*Elymus hystrix*), switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), big cordgrass (*Spartina cynosuroides*), eastern gama grass (*Tripsacum dactyloides*)

Herbaceous Plants

Common Daylily

Hemerocallis fulva



B. Slattery, USFWS

Common daylily was introduced to the United States from Europe in the late 19th century. It is a very popular ornamental prized for its hardiness and variety – there are now over 40,000 registered cultivars! Daylilies that have escaped from landscape plantings infest natural areas where they pose the greatest threat to meadows, floodplains, moist woods and forest edges. Daylilies reproduce by seed and also from thick, tuberous roots that grow rapidly to form dense clumps. Gardeners inadvertently spread daylilies by throwing away whole plants. They are difficult to control because of their thick tuberous roots.

Prevention and Control

Use spade/shovel to loosen soil and dig up root system. Re-sprouting may occur if entire root system is not removed.

Native Alternatives

ox-eye sunflower (*Heliopsis helianthoides*), Canada lily (*Lilium canadense*), wood lily (*Lilium philadelphicum*), Turk's cap lily (*Lilium superbum*), three-lobed coneflower (*Rudbeckia triloba*)

Common Reed

Phragmites australis



Joseph McCauley, USFWS

Common reed is a tall grass that inhabits wet areas like brackish and freshwater marshes, riverbanks, lakeshores, ditches and dredge spoil areas. Native and introduced forms of *Phragmites* occur in the United States. Researchers believe that introduced European forms are the aggressive invasives that have replaced much of our native reed. Common reed threatens by displacing native plants and forming monocultures in otherwise biologically diverse natural wetlands. It spreads by seed and strong vegetative growth and is very difficult to control once established.

Prevention and Control

Control of *Phragmites* is difficult, time-consuming, labor intensive and costly. Cutting, burning and chemical herbicides are all used to control it under various circumstances. Researchers have recently begun investigating the potential for biological control of this plant.

Native Alternatives

After controlling *Phragmites*, replant area with native wetland plants suitable to the site's salinity and wetness. Contact federal or state natural resource agencies for assistance in selecting and locating native alternatives. Refer to References on pages 76-78.

Giant Hogweed

Heracleum mantegazzianum



USDA, APHIS

Giant hogweed was introduced from Eurasia around 1917 for use as an ornamental plant. It is a tall, showy member of the parsley family (Apiaceae), growing from 8 to 14 feet in height. Its thick stems have purple blotches and coarse hairs. Giant hogweed has escaped cultivation and may become established in rich, moist soils along roadsides, stream banks and disturbed areas. It is a dangerous, poisonous plant that should not be touched. It spreads by seed.

Prevention and Control

Do not cultivate, plant, purchase, or transplant this plant. It is very difficult to control. If found, notify your state Department of Agriculture, who will handle control measures.

Native Alternatives

Joe Pye weed (*Eupatorium dubium* or *fistulosum*), boneset or white snake root (*Eupatorium perfoliatum* or *rugosum*), elderberry (*Sambucus canadensis*), southern arrowwood (*Viburnum dentatum*)

Giant Reed

Arundo donax

Giant reed, a native of India, is a tall perennial grass growing to 20 feet or more in height. It is used as an ornamental plant and for erosion control and tolerates a wide variety of conditions, including high salinity. Its vigorous growth displaces native plant species. It spreads vegetatively through rhizomes and root and stem fragments carried by water.

Prevention and Control

Infested areas are best restored through chemical means. Repeated mowing may be effective but in some cases re-growth from root fragments can occur. Systemic herbicides, such as glyphosate, may be applied to clumps of giant reed, after flowering.

Native Alternatives

big bluestem (*Andropogon gerardii*), bushy beardgrass (*Andropogon glomeratus*), switchgrass (*Panicum virgatum*), big cordgrass (*Spartina cynosuroides*), eastern gama grass (*Tripsacum dactyloides*)



John M. Randall, TNC

Marsh Dewflower

Murdannia keisak



B. Steury, NPS

Marsh dewflower, a member of the spiderwort family and native of eastern Asia, was first noted in 1935 in cultivated rice paddies in South Carolina. It escaped and has become established in the wild in 18 southern states and the District of Columbia. Marsh dewflower prefers damp soil at the edge of freshwater tidal marshes, around ponds and along slow moving streams. Its aggressive growth enables it to out-compete native plants by forming dense mats. Seeds are dispersed by wildlife. It also spreads when floods distribute root fragments to new locations.

Prevention and Control

Hand pulling may be effective if done before the plant sets seed. Glyphosate treatments were ineffective when applied early in the season.

Native Alternatives

water plantain (*Alisma subcordatum*), three-way sedge (*Dulichium arundinaceum*), duck-potato or arrowhead (*Sagittaria latifolia* or *rigida*)

Spotted Knapweed

Centaurea biebersteinii



J. Story, U of MT

Spotted knapweed, a member of the aster family, was introduced unintentionally from Eurasia as a contaminant of alfalfa and from soil used as ship ballast. It poses a threat to natural communities such as barrens, fields, meadows and forest edges because it captures moisture and nutrients, forms a deep taproot and spreads rapidly through seed. Several insect species are being used as biological control agents.

Prevention and Control

To avoid transporting seed and infested soil, do not graze livestock in infested areas – especially when seeds are present – and use certified weed-free hay. Plants can be pulled by hand in small infestations, ensuring removal of the entire crown and taproot. Several herbicides are effective but require repeat applications. Clean shoes and clothing when leaving infested areas.

Native Alternatives

After eradicating, plant area with native vegetation appropriate to site conditions. Refer to References on pages 76-78.



Left: Daylilies (*Hemerocallis fulva*) can spread quickly from garden plantings.



Below left: Purple loosestrife (*Lythrum salicaria*) spreads to wetlands where it can replace native vegetation.



Below: Miscanthus or Chinese silver grass (*Miscanthus sinensis*) escaped from a single plant and now dominates this property.

All photos on this page by Britt Slaterry, USFWS

Shrubs

Autumn Olive

Elaeagnus umbellata

Origin East Asia

Background

Autumn olive was introduced into the United States in 1830 and widely planted as an ornamental, for wildlife habitat, as windbreaks and to restore deforested and degraded lands.

Distribution and Ecological Threat

Autumn olive is found from Maine to Virginia and west to Wisconsin. It is drought tolerant and thrives in a variety of soil and moisture conditions. This trait allows it to invade grasslands, fields, open woodlands and disturbed areas. It threatens native ecosystems by out-competing and displacing native plant species, creating dense shade and interfering with natural plant succession and nutrient cycling. Because autumn olive is capable of fixing nitrogen in its roots, it can grow on bare mineral substrates.

Description and Biology

- Plant: deciduous shrub that can grow to 20 feet in height; stems, buds and leaves have a dense covering of silvery to rusty scales.
- Leaves: egg or lance-shaped, smooth margined and alternate along the stem; underside of leaves covered with silver-white scales.
- Flowers, fruits and seeds: plants begin to flower after three years. Small, light yellow, aromatic flowers appear in June and July; fruits are small, round, pink to reddish and dotted with scales.
- Spreads: by seed, although some vegetative propagation also occurs. Birds and mammals disperse fruits.



USDA, NRCS



USDA, NRCS

Prevention and Control

Do not plant autumn olive. Individual young plants can be hand-pulled, ensuring that roots are removed. Cutting, in combination with herbicide application, is effective. Hedges can be cut down using a brush type mower, chain saw, or similar tool, and stumps treated with a systemic herbicide like glyphosate or triclopyr. Application of these herbicides to foliage is also effective but is likely to impact non-target species. Herbivorous animals are not known to feed on it and few insects seem to utilize or bother it. Canker disease is occasionally a problem but not enough to be useful as a control agent.

Native Alternatives

spicebush
(*Lindera benzoin*)



Chris Miller, NRCS

arrowwood
(*Viburnum dentatum*)



Britt Slattery, USFWS

gray dogwood
(*Cornus racemosa*)



Britt Slattery, USFWS

northern bayberry
(*Myrica pensylvanica*)



Chris Miller, NRCS

black haw
(*Viburnum prunifolium*)



Chris Miller, NRCS

winterberry
(*Ilex verticillata*)



Chris Miller, NRCS

Shrubs

Exotic Bush Honeysuckles

Amur (*Lonicera maackii*),
Bell's (*L. x bella*),
Dwarf (*L. xylosteum*),
Fragrant (*L. fragrantissima*),
Morrow's (*L. morrowii*),
Standish's (*L. standishii*),
Tartarian (*L. tatarica*)



James L. Reveal

Origin: Eurasia, Japan, China, Korea, Manchuria, Turkey and southern Russia

Background

Exotic bush honeysuckles have been used for many years as ornamentals, for wildlife cover and for soil erosion control. Exotic bush honeysuckles out-compete and displace native plants and alter natural habitats by decreasing light availability and depleting soil moisture and nutrients for native species. Exotic bush honeysuckles compete with native plants for pollinators, resulting in reduced seed set for native species. Unlike native shrubs, the fruits of exotic bush honeysuckles are carbohydrate-rich and do not provide migrating birds with the high-fat content needed for long flights.

Distribution and Ecological Threat

Amur, Tartarian, Morrow's and Bell's honeysuckle generally range from the central Great Plains to southern New England and south to Tennessee and North Carolina. The remaining species are sporadically distributed. Exotic bush honeysuckles are relatively shade-intolerant and most often



John, M. Randall, TNC

occur in forest edge, abandoned field, pasture, roadsides and other open, upland habitats. Woodlands, especially those that have been grazed or otherwise disturbed, may also be invaded by exotic bush honeysuckles. Morrow's honeysuckle and Bell's honeysuckle have the greatest habitat breadth and are capable of invading bogs, fens, lakeshores, sand plains and other uncommon habitat types.

Description and Biology

- **Plant:** upright, generally deciduous shrubs from 6 to 15 feet in height. Older stems are often hollow.
- **Leaves:** 1 to 2 1/2 inch, egg-shaped leaves are opposite along the stem and short-stalked.
- **Flowers, fruits and seeds:** pairs of fragrant, tubular flowers less than 1 inch long are borne along the stem in the leaf axils. Flower color varies from creamy white to pink or crimson in some varieties of Tartarian honeysuckle. Flowering generally occurs from early to late spring, but varies for each species and cultivar. The fruits are red to orange, many-seeded berries that ripen from early summer to fall depending on the species.
- **Spreads:** prolific fruits are highly attractive to birds. Vegetative sprouting aids in the persistence and spread of these exotic shrubs.
- **Look-alikes:** native species of shrub honeysuckles; most native bush honeysuckles have solid stems, and exotic species have hollow stems.

Prevention and Control

Mechanical and chemical methods are the primary means of control of exotic bush honeysuckles. No biological control agents are currently available for these plants. Hand removal of seedlings or small plants may be useful for light infestations.

Native Alternatives

arrowwood
(*Viburnum dentatum*)



Britt Slattery, USFWS

northern bayberry
(*Myrica pensylvanica*)



Chris Miller, NRCS

swamp rose
(*Rosa palustris*)



Chris Miller, NRCS

groundsel tree
(*Baccharis halimifolia*)



Britt Slattery, USFWS

spicebush
(*Lindera benzoin*)



Chris Miller, NRCS

red or black chokeberry
(*Aronia arbutifolia* or *melanocarpa*)



Britt Slattery, USFWS

Shrubs

Japanese Barberry

Berberis thunbergii

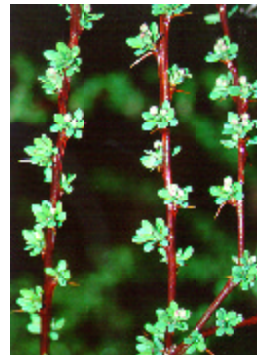
Origin: Japan

Background

Japanese barberry was introduced to the United States as an ornamental in 1875. Seeds were sent from Russia to the Arnold Arboretum in Boston, Massachusetts. In 1896, it was planted at the New York Botanic Garden. It was eventually promoted as a substitute for *Berberis vulgaris*, an exotic plant introduced and used by early settlers from Europe for hedgerows, dyes and jams, and later found to be a host for the black stem rust of wheat.



Britt Slattery, USFWS



John M. Randall, TNC

Distribution and Ecological Threat

In the United States, Japanese barberry occurs throughout much of New England and the Northeast, south to North Carolina and west to Michigan and Missouri. Barberry forms dense stands in a variety of habitats, including closed canopy forests and open woodlands, wetlands, pastures, meadows and wastelands. This highly shade-tolerant exotic shrub displaces a variety of native herb and shrub species in areas where it is well established.

Description and Biology

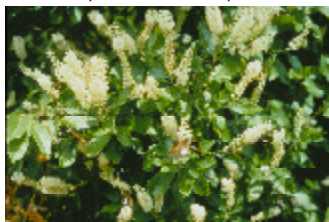
- **Plant:** a dense, deciduous shrub that grows 2 to 8 feet high. The branches are deeply grooved, brown and usually have simple spines.
- **Leaves:** 1/2 to 1 1/2 inches long and shaped like small spatulas or narrow ovals, with a color ranging from green to bluish-green to dark reddish purple.
- **Flowers, fruits and seeds:** flowering occurs from mid-April to May in the Northeast and the fruits mature from July to October and will persist through the winter. The abundant pale yellow flowers occur along the entire length of the stem. Flowers are in clusters of two to four and produce bright red berries about 1/3 inch long.
- **Spreads:** by seeds eaten by small mammals and birds (e.g. turkey and grouse) and through vegetative means.

Prevention and Control

Do not plant Japanese barberry. Small plants can be pulled by hand, using thick gloves to avoid injury from the spines. A weed wrench® can be used to uproot older shrubs when soil is moist. Shrubs can also be mowed or cut repeatedly. Treatment with systemic herbicides like glyphosate and triclopyr has been effective.

Native Alternatives

sweet pepperbush
(*Clethra alnifolia*)



USFWS

northern bayberry
(*Myrica pensylvanica*)



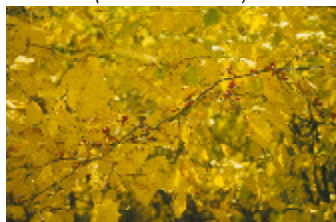
Chris Miller, NRCS

highbush blueberry
(*Vaccinium corymbosum*)



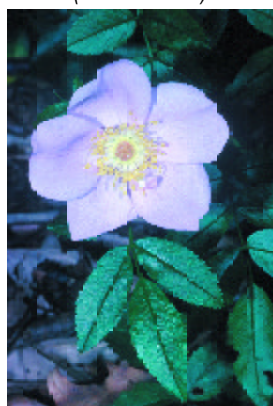
Britt Slattery, USFWS

spicebush
(*Lindera benzoin*)



Chris Miller, NRCS

pasture rose
(*Rosa carolina*)



R. Harrison Wiegand

swamp rose
(*Rosa palustris*)



Chris Miller, NRCS

Shrubs

Multiflora Rose

Rosa multiflora

Origin: Japan, Korea
and Eastern China

Background

Multiflora rose was introduced to the eastern United States in 1866 as rootstock for ornamental roses. Beginning in the 1930s, the U.S. Soil Conservation Service promoted it for use in erosion control and as “living fences” to confine livestock. State conservation departments recommended multiflora rose as cover for wildlife. More recently, multiflora rose has been planted in highway median strips to serve as crash barriers and to reduce automobile headlight glare. Its tenacious growth habit was eventually recognized as a problem on pastures and unplowed lands, where it disrupted cattle grazing, and, more recently, as a pest of natural ecosystems. It is designated a noxious weed in several states, including Iowa, Ohio, New Jersey, Pennsylvania and West Virginia.



James H. Miller

Distribution and Ecological Threat



James H. Miller

Multiflora rose occurs throughout the eastern half of the United States and in Washington and Oregon. It tolerates a wide range of soil, moisture and light conditions and is able to invade fields, forests, prairies, some wetlands and many other habitats. Multiflora rose grows aggressively and produces

large numbers of fruits (hips) that are eaten and dispersed by a variety of birds. Dense thickets of multiflora rose exclude most native shrubs and herbs from establishing and may be detrimental to nesting of native birds.

Description and Biology

- Plant: a thorny, perennial shrub with arching stems.
- Leaves: divided in five to eleven sharply toothed leaflets; base of each leaf stalk bears a pair of small fringed structures (stipules).

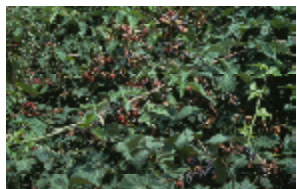
- Flowers, fruits and seeds: clusters of showy, fragrant, white to pinkish, 1 inch wide flowers appear during May; small bright red fruits, or rose hips, develop during the summer and remain on the plant through the winter.
- Spreads: reproduces by seed and by forming new plants from the tips of arching canes that can root where they contact the ground. An average plant produces an estimated one million seeds per year, which remain viable in the soil for up to 20 years.
- Look-alikes: pasture rose (*Rosa carolina*); swamp rose (*Rosa palustris*); Allegheny blackberry (*Rubus allegheniensis*); flowering raspberry (*Rubus odoratus*). Only multiflora rose has the combination of upright arching stems and fringed stipules.

Prevention and Control

Young plants may be pulled by hand. Mature plants can be controlled through frequent, repeated cutting or mowing. Several contact and systemic herbicides are also effective in controlling multiflora rose. Follow-up treatments are likely to be needed. Two naturally occurring biological controls affect multiflora rose to some extent: a native fungal pathogen (rose-rosette disease) that is spread by a tiny native mite and a non-native seed-infesting wasp, the European rose chalcid.

Native Alternatives

common blackberry
(*Rubus allegheniensis*)



Chris Miller, NRCS

flowering raspberry
(*Rubus odoratus*)



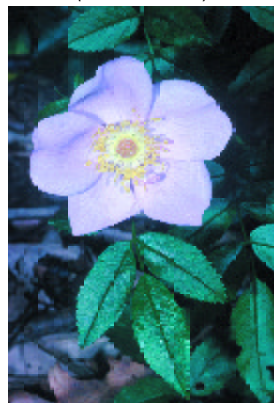
R. Harrison Wiegand

swamp rose
(*Rosa palustris*)



Chris Miller, NRCS

pasture rose
(*Rosa carolina*)



R. Harrison Wiegand

Shrubs

Privets

Border Privet
(*Ligustrum obtusifolium*),
Chinese Privet (*L. sinense*),
European Privet
(*L. vulgare*),
Japanese Privet
(*L. japonicum*)



H. Schneider

Origin: Europe, China, Japan and Korea

Background

Various species of privet have been introduced to the United States as garden plants and are widely used as hedges. European privet was introduced sometime during the 1700s, obtuse-leaved privet in 1860, Japanese privet in 1945 and Chinese privet in 1952. They escaped cultivation and are now established throughout the eastern part of the country.

Distribution and Ecological Threat

European privet occurs in scattered locations across the United States. Chinese and Japanese privet are found in the Southeast and Midwest. Border privet is found in most of the Northeast. Privets can invade floodplains, forests, wetlands and fields. Privets form dense thickets, out-competing native vegetation.

Description and Biology

- Plant: stout, many-branched shrubs in the olive family (Oleaceae); can grow to 15 feet tall.
- Leaves: oval to elliptical on short stalks, in pairs along stem; phenolic compounds in leaves protect against damage from insects.
- Flowers, fruits and seeds: small white flowers grow in clusters at ends of branches; fruits are small blue-black berries produced during late summer to early fall.
- Spreads: by seed dispersed by birds and other wildlife that eat the fruits and excrete seeds undamaged; can also grow from stumps and stump sprouts.

Prevention and Control

Do not plant privets. Small plants can be dug out. For larger plants, spray leaves with glyphosate herbicide or paint on freshly cut stumps.

Native Alternatives

inkberry
(*Ilex glabra*)



Britt Slattery, USFWS

spicebush
(*Lindera benzoin*)



Chris Miller, NRCS

blackhaw
(*Viburnum prunifolium*)



Chris Miller, NRCS

red or black chokeberry
(*Aronia arbutifolia* or *melanocarpa*)



Britt Slattery, USFWS

Shrubs

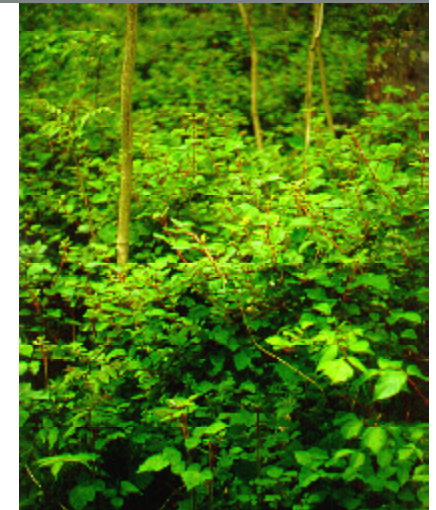
Wineberry

Rubus phoenicolasius

Origin: Japan, Korea and China

Background

Introduced into the United States in 1890 as breeding stock for new *Rubus* (raspberry genus) cultivars and still used today by berry breeders. It is prized for its delicious raspberry-like berries that are produced in great abundance in summer.



John M. Randall, TNC

Distribution and Ecological Threat



Jil Swearingen, NPS

Wineberry is found from New England and eastern Canada to North Carolina and west to Michigan and Tennessee. It occurs along forest, field, stream and wetland edges and in open woods, preferring moist habitats. Wineberry poses a threat to native flora because of its vigorous growth, which allows it to crowd out native plants and establish extensive patches.

Description and Biology

- Plant: typical blackberry appearance, except for the conspicuous and distinctive reddish, glandular hairs that cover all parts of the plant.
- Leaves: alternate along the stem, are divided into three heart-shaped leaflets with purple veins and toothed margins.
- Flowers, fruits and seeds: small green flowers with white petals and small reddish hairs occur in the spring and are followed by showy bright red fruits in early summer. The fruits are enclosed in a husk until ripe when the sepals spread exposing the orange to red raspberry type fruit.



Britt Slattery, USFWS

- Spreads: by seeds transported by birds, mammals, and people, and by vegetative means. New plants can grow from arching canes that touch the ground, and from root buds.

Prevention and Control

Do not plant wineberry. Wineberry can be controlled through mechanical means or by treating the canes with a systemic herbicide like glyphosate or triclopyr.

Native Alternatives

red or black chokeberry
(*Aronia arbutifolia* or *melanocarpa*)



Britt Slattery, USFWS

common blackberry
(*Rubus allegheniensis*)



Britt Slattery, USFWS

flowering raspberry
(*Rubus odoratus*)



R. Harrison Wiegand

winterberry
(*Ilex verticillata*)



Chris Miller, NRCS

spicebush
(*Lindera benzoin*)



Chris Miller, NRCS

Shrubs

Winged Burning Bush

Euonymus alata

Origin: Northeastern Asia, Japan and Central China

Background

Introduced for use as an ornamental plant for landscaping beginning about 1860. Widely planted by landscape professionals and homeowners for its fall color, dark green leaves, winged stems and other characteristics.



USDA, NRCS

Distribution and Ecological Threat



Britt Slattery, USFWS

In the United States, winged burning bush is found from New England to northern Florida and the Gulf Coast and also in Illinois. It threatens a variety of habitats including forests, coastal scrublands and prairies where it forms dense thickets, displacing many native woody and herbaceous plant species. Hundreds of seedlings are often found below the parent plant in what is termed a "seed shadow."

Description and Biology

- **Plant:** multiple stemmed, angular branching shrub with conspicuously winged stems, normally 5 to 10 feet high but mature plants can grow to 20 feet.
- **Leaves:** deciduous, dark green, in pairs along stem, turn brilliant red-purple in autumn.
- **Flowers, fruits and seeds:** inconspicuous, greenish flowers occur in late spring and red-purple fruits mature during summer.
- **Spreads:** expands locally through vegetative reproduction and to new areas through bird dispersal of seeds.
- **Look-alikes:** may be confused with other species of euonymus, including our native strawberry bush, or 'hearts-a-bustin' (*Euonymus americana*), which does not have winged stems. Saplings of native sweetgum (*Liquidambar styraciflua*) with winged stems may also be mistaken for winged burning bush.

Prevention and Control

Do not plant winged burning bush. Manual, mechanical and chemical means are available to control established plantings. Seedlings can be pulled by hand. Shrubs can be repeatedly cut to the ground to control re-sprouts, or cut and treated with systemic herbicides like glyphosate and triclopyr.

Native Alternatives

red chokeberry
(*Aronia arbutifolia*)



Both photos, Britt Slattery, USFWS

Virginia sweetspire
(*Itea virginica*)



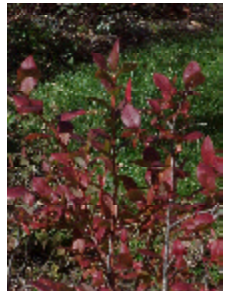
Britt Slattery, USFWS

mapleleaf viburnum
(*Viburnum acerifolium*)



USDA

highbush blueberry
(*Vaccinium corymbosum*)



Britt Slattery, USFWS

silky dogwood
(*Cornus amomum*)



Chris Miller, NRCS

fragrant or shining sumac
(*Rhus aromatica* or *copallina*)

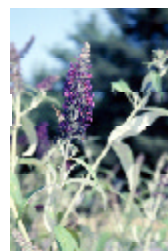


Britt Slattery, USFWS

Shrubs

Butterfly Bush

Buddleja species



Britt Slattery, USFWS

Butterfly bush species from Asia and Central America are popular ornamental plants widely used to attract butterflies. There are more than 100 species of *Buddleja* worldwide and additional cultivars are being developed. *Buddleja* species are currently found throughout the eastern, southern and western states. Butterfly bush can escape from plantings and become invasive in a variety of natural habitats such as coastal forest edges, roadsides, abandoned railroads, rural dumps, stream and river banks and some disturbed habitats.

Buddleja displace native plants. It spreads by seed that is produced in abundance and dispersed by the wind.

Prevention and Control

On isolated ornamental shrubs, cut off fading flowers before seed forms. Hand weed young plants or use a glyphosate herbicide. However, disturbance caused by removal often results in new plants. To achieve total removal, it is best to ensure a rapid ground cover of a non-invasive species, which will prevent butterfly bush from re-establishing.

Native Alternatives

butterflyweed (*Asclepias tuberosa*), sweet pepperbush (*Clethra alnifolia*), Virginia sweetspire (*Itea virginica*), blazing star (*Liatris spicata*), New York ironweed (*Vernonia noveboracensis*)

Japanese Spiraea

Spiraea japonica



Wm. S. Justice

Japanese spiraea, a native of Japan, Korea and China, was introduced into the United States for ornamental cultivation around 1870. It is a very popular landscape shrub that produces showy pink flowers in spring. Spiraea invades a variety of natural habitats including fields, forests, stream and river edges, and disturbed areas like roadsides and power line rights-of-way. It tolerates a wide range of soil and light conditions. Spiraea grows rapidly and densely, displacing many native herbs and shrubs. It flowers profusely, producing large numbers of seeds that are dispersed away from the parent plant by water.

Prevention and Control

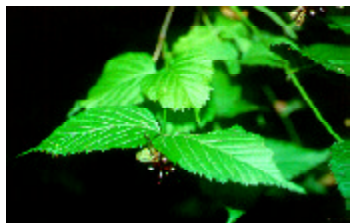
Cutting may be effective for small populations or environmentally sensitive areas. Repeated mowing or cutting will control the spread of spiraea, but will not eradicate it. Systemic herbicides can also be used.

Native Alternatives

sweet pepperbush (*Clethra alnifolia*), silky dogwood (*Cornus amomum*) Virginia sweetspire (*Itea virginica*), pinxterbloom azalea (*Rhododendron periclymenoides*)

Jetbead

Rhodotypos scandens



John M. Randall, TNC

Jetbead is an attractive shrub in the rose family (Rosaceae) that was introduced from Central China, Korea and Japan in 1866. It is a multi-stemmed deciduous shrub that flowers in the spring, producing attractive clusters of white, four-petaled flowers. Found in at least 17 states east of the Mississippi, it has recently come to the attention of land managers who noticed it becoming invasive in natural habitats away

from intentional plantings. Once established, it shades out native plants in the ground layer and inhibits native tree generation. It spreads by seed and by vegetative means.

Prevention and Control

Small plants may be removed by hand digging, provided the entire root system is removed. For larger infestations, cut shrubs to the ground in the fall or winter and apply a glyphosate herbicide to new growth in the spring.

Native Alternatives

black chokeberry (*Aronia arbutifolia*), spicebush (*Lindera benzoin*), pasture rose (*Rosa carolina*), mapleleaf viburnum (*Viburnum acerifolium*), southern arrowwood (*Viburnum dentatum*)

Bush honeysuckles such as this **Amur honeysuckle** (*Lonicera maackii*) bear distinctive clusters of red berries. Though popular with birds, these berries lack nutrition value.



Warner Park Nature Center

Bush honeysuckles may have white, yellow, or pink flowers such as this **Tartarian honeysuckle** (*Lonicera tatarica*).



Oregon State University

Trees

Bradford Pear

Pyrus calleryana 'Bradford'

Origin: China

Background

Bradford pear is a cultivar of the Callery pear that is widely used to landscape residential developments, parking lots and roadsides. The original 'Bradford' cultivar was introduced to Maryland in the early 1900s and had sterile fruits. However, new hybrids, developed to correct the tendency of the tree to split and fall apart under wind and snow events, were not sterile. Bradford pear has escaped plantings and is invading natural habitats in the eastern United States.



Britt Slattery, USFWS

Distribution and Ecological Threat

Grown throughout the United States, Bradford pear grows best in full sun but will tolerate partial shade and a variety of soil types and conditions, including occasional wet soils or drought. New hybrids produce viable seeds through cross-pollination with the Bradford cultivar. The descendants are aggressively invading natural and disturbed open areas, displacing native plant communities and disrupting natural succession.

Description and Biology

- Plant: grows 30 to 50 feet tall and 20 to 30 feet wide; exhibits rapid growth (12 to 15 foot increase in height over 8 to 10 years); has a short to moderate life span (25 to 30 years).



Britt Slattery, USFWS

- Leaves: simple, alternate, deciduous, shiny green and leathery with round-toothed margins; turn mahogany-red and sometimes bright orange-red in late autumn.
- Flowers, fruits and seeds: produces showy white flowers in the spring before the leaves expand; small, round, brown fruits appear during late spring and summer.
- Spreads: by seeds that are dispersed to new locations by starlings and other birds that eat the fruits.
- Look-alikes: apple trees (*Malus* species), basswood (*Tilia* species).

Prevention and Control

Do not plant Bradford pear. Seedlings and shallow-rooted plants can be pulled when soil is moist. Small trees need to be dug up or pulled out using a Weed Wrench®, ensuring removal of the root system. Large trees should be cut down and stumps treated with an appropriate systemic herbicide (e.g., glyphosate or triclopyr), following label directions, or ground up to prevent resprouting. If cutting is not possible, trees can be girdled during the spring and summer, by cutting through the bark all around the trunk, about 6" above the ground.

Native Alternatives



black haw
(*Viburnum prunifolium*)

Chris Miller, NRCS



redbud
(*Cercis canadensis*)

Britt Slattery, USFWS



serviceberry
(*Amelanchier canadensis*)

Chris Miller, NRCS



southern arrowwood
(*Viburnum dentatum*)

Britt Slattery, USFWS



fringetree
(*Chionanthus virginicus*)

R. Harrison Wiegand

Trees

Norway Maple

Acer platanoides

Origin: Europe and Western Asia

Background

Introduced for use as an ornamental landscape plant.



Britt Slattery, USFWS

Distribution and Ecological Threat

Norway maple is found in 13 states in the eastern United States, from Maine to Virginia and west to Wisconsin. It is recognized as an invasive plant in many of these states. Norway maple has escaped cultivation and invades forests, fields, and other natural habitats. It forms monotypic stands that create dense shade and it displaces native trees, shrubs and herbs.

Description and Biology

- Plant: grows up to 90 feet in height, has a broadly-rounded crown and bark that is smooth at first but becomes black, ridged and furrowed with age.
- Leaves: deciduous, dark green, palmate or hand-shaped, generally broader than long, opposite (in pairs) along stem, milky sap in veins.
- Flowers, fruits and seeds: flowers are bright yellow-green and appear in spring; fruits mature during the summer into typical winged "samaras" that look like helicopter blades with a seed in the center.
- Spreads: expands locally by vegetative reproduction and to new areas by seed.
- Look-alikes: Norway maple can be confused with many maples species, especially sugar maple (*Acer saccharum*), because of similar looking leaves. It can be distinguished from native maples by the presence of a milky white sap that oozes out of leaf veins and stalks when broken. Norway maple is easily spotted in the autumn when its leaves turn yellow late in the season.



John M. Randall, TNC

Prevention and Control

Don't plant Norway maple. To control existing stands, manual, mechanical and chemical means are available. Seedlings can be pulled by hand and small to large trees can be cut to the ground, repeating as necessary to control any re-growth from sprouts. Glyphosate and triclopyr herbicides have been successfully used to control Norway maple.

Native Alternatives

American beech
(*Fagus grandifolia*)



Chris Miller, NRCS

sourwood
(*Oxydendrum arboreum*)



USDA, NRCS

willow oak
(*Quercus phellos*)



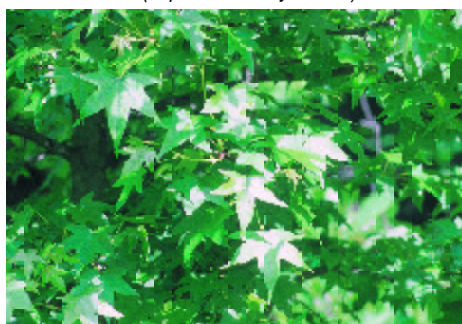
Chris Miller, NRCS

red maple
(*Acer rubrum*)



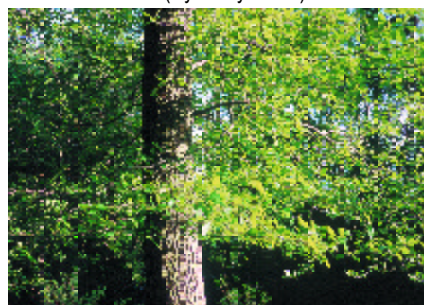
Britt Slattery, USFWS

sweet gum
(*Liquidambar styraciflua*)



Chris Miller, NRCS

black gum
(*Nyssa sylvatica*)



Chris Miller, NRCS

Princess Tree

Paulownia tomentosa

Origin: Central and Western China

Background

Imported to Europe by the Dutch East India Company in the 1830s and brought to North America soon after. Historical records describe its medicinal, ornamental and timber uses as early as the 3rd century B.C. Its ability to sprout prolifically from adventitious buds on stems and roots allows it to survive fire, cutting and even bulldozing in construction areas. It is prized for carving.



Randy Baldwin

Distribution and Ecological Threat

Princess tree occurs throughout much of the eastern United States from Texas to New England where it can be found growing along roadsides, stream banks and forest edges. It tolerates infertile and acid soils and drought conditions and adapts to a wide variety of habitats. Princess tree invades forests, stream banks and some rocky habitats, displacing native plant species.

Description and Biology

- **Plant:** small to medium sized tree in the figwort family (Scrophulariaceae) that reaches 30 to 60 feet in height; bark is rough, gray-brown and interlaced with shiny, smooth areas; stems are olive to dark brown, hairy and markedly flattened where stems and branches meet.
- **Leaves:** large, hairy on upper surfaces, broadly oval to heart-shaped and sometimes shallowly three-lobed and in three pairs along the stem.
- **Flowers, fruits and seeds:** conspicuous upright clusters of showy, pale violet, fragrant flowers open in the spring before the leaves appear; fruit is a brown capsule with four compartments



James H. Miller

that may contain several thousand tiny winged seeds; fruits mature in the fall and remain on the tree, providing a handy identification aid.

- Spreads: a single tree is capable of producing an estimated twenty million seeds that are easily transported long distances by wind and water and germinate easily in suitable soil; seedlings grow quickly and flower within 8 to 10 years.

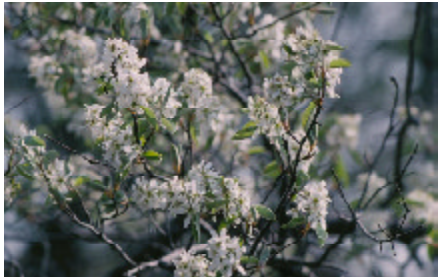
Prevention and Control

Do not plant princess tree. Young plants can be hand-pulled but larger trees need to be cut at ground level with power or manual saws, preferably prior to seed formation to prevent further spread. Systemic herbicides have also been used to control this plant.

Native Alternatives

serviceberry

(*Amelanchier canadensis* or *arborea*)



Chris Miller, NRCS

sweetbay magnolia

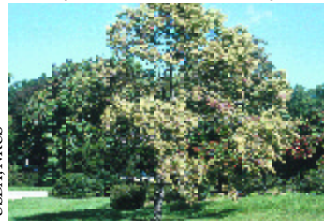
(*Magnolia virginiana*)



R. Harrison Wiegand

sourwood

(*Oxydendrum arboreum*)



USDA, NRCS

flowering dogwood

(*Cornus florida*)



Britt Slattery, USFWS

redbud

(*Cercis canadensis*)



Britt Slattery, USFWS

Trees

Tree of Heaven

Ailanthus altissima

Origin: Central China

Background

Introduced by a Pennsylvania gardener in 1748 and into California by immigrants during the gold rush years, Tree of Heaven, also called stinking sumac, was available commercially by 1840.



Paul Wray

Distribution and Ecological Threat



Britt Slattery, USFWS

Widely distributed across the United States, Tree of Heaven occurs in 42 states, from Maine to Florida and west to California. It is an extremely common tree in urban areas where it can cause damage to sewers and structures but poses a greater environmental threat because of its invasiveness in cultivated fields and natural habitats. A prolific seeder,

Tree of Heaven grows vigorously, establishing dense stands that displace native plants. It produces chemicals that kill or prevent other plants from growing in its vicinity.

Description and Biology

- Plant: a rapidly growing, deciduous tree in the mostly tropical quassia family (Simaroubaceae). Mature trees can reach 80 feet or more in height. *Ailanthus* has smooth stems with pale gray bark, and twigs that are light chestnut brown, especially in the dormant season. Tree of Heaven is dioecious, meaning plants are either male or female. The wood of *Ailanthus* is soft, weak, coarse-grained and creamy white to light brown in color. All parts of the tree, especially the flowers, have a strong, offensive odor, which some have likened to cat urine or rotting peanuts or cashews.
- Leaves: large compound leaves, 1 to 4 feet in length, composed of 11 to 25 smaller leaflets and alternate along the stems. Each leaflet has one to several glandular teeth near the base.
- Flowers, fruits and seeds: large clusters of small greenish flowers are produced during June; in the late summer, female trees produce flat,

twisted, papery fruits called samaras that may remain on the trees for long periods of time; an individual tree can produce up to 325,000 seeds per year.

- Spreads: reproduces by seed and by vigorous re-sprouting, especially in response to injury such as cutting or breaking.
- Look-alikes: staghorn sumac (*Rhus typhina*), ash (*Fraxinus* species) and black walnut (*Juglans nigra*). The sumac has fuzzy, reddish-brown leaves and stems. All ash species have opposite leaves. Black walnut leaves are toothed, large green fruits fall from the tree.

Prevention and Control

Correct identification of Tree of Heaven is essential. Native shrubs are often confused with it. Elimination of *Ailanthus* requires diligence, due to its abundant seed production, high seed germination rate and vigorous vegetative reproduction. Targeting large female trees for control will help reduce spread by seed. Young seedlings may be pulled or dug up, preferably when soil is moist. Care must be taken to remove the entire plant including all roots and fragments as these will almost certainly re-grow. Extensive research has been conducted on herbicidal methods of control for Tree of Heaven and include leaf, bark and cut stem applications.

Native Alternatives

box elder
(*Acer negundo*)



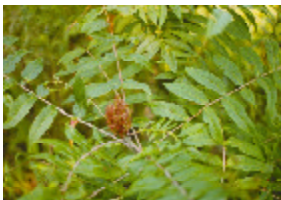
Britt Slattery, USFWS

green or white ash
(*Fraxinus pennsylvanica* or
americana)



Kitty Kohout, UWI

smooth sumac
(*Rhus glabra*)



Chris Miller, NRCS

fringetree
(*Chionanthus virginicus*)



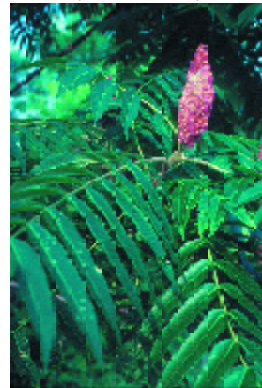
R. Harrison Wiegand

black walnut
(*Juglans nigra*)



Dennis Woodland, UWI

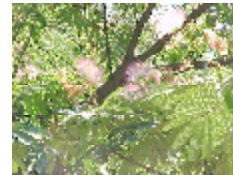
staghorn sumac
(*Rhus typhina*)



R. Harrison Wiegand

Silk Tree, Mimosa Tree

Albizia julibrissin



Britt Slattery, USFWS

Silk tree, sometimes called mimosa tree, was introduced to the United States in 1745 for use as an ornamental plant because of its unusual, attractive and fragrant pom-pom like flowers and interesting fern-like foliage. It occurs from California across the southern United States to New York in disturbed areas such as roadsides, forest edges and various open habitats. Silk tree is a hardy plant in the pea family (Fabaceae) that tolerates a variety of soil and moisture conditions, enhanced by its ability to produce nitrogen in its roots. It grows vigorously and displaces native trees and shrubs, spreading by seed and vegetative means.

Prevention and Control

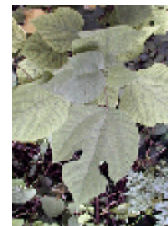
Avoid planting silk tree. Trees can be cut at ground level with power or manual saws. Cutting is an initial control measure, best done prior to seed set, and usually requires follow-up cuttings or herbicidal treatments due to re-sprouts.

Native Alternatives

serviceberry (*Amelanchier arborea*), river birch (*Betula nigra*), redbud (*Cercis canadensis*), fringetree (*Chionanthus virginicus*), flowering dogwood (*Cornus florida*), sweetgum (*Liquidambar styraciflua*)

Paper Mulberry

Broussonetia papyrifera



Shirley Denton

Paper mulberry, an ornamental tree in the mulberry family (Moraceae), is native to Japan and Taiwan and was introduced for its use as a fast-growing shade tree. Native Pacific cultures use it to make bark cloth. It is found from Illinois to Massachusetts, south to Florida and west to Texas. Paper mulberry invades open habitats such as forest and field edges and its vigorous growth leads to displacement of native plant species. Its shallow root system makes it susceptible to blow over during high winds. It spreads by seed and vegetative growth.

Prevention and Control

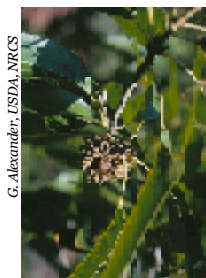
Don't plant paper mulberry. Seedlings can be pulled by hand and shrubs can be cut to the ground, repeating as necessary to control any re-growth from sprouts. Application of the herbicide triclopyr to the bark has been successful. Similar looking native trees include red mulberry (*Morus rubra*), American basswood (*Tilia americana*) and sassafras (*Sassafras albidum*).

Native Alternatives

red maple (*Acer rubrum*), hackberry (*Celtis occidentalis*), black gum (*Nyssa sylvatica*), sassafras (*Sassafras albidum*)

Sawtooth Oak

Quercus acutissima



G. Alexander, USDA, NRCS

Sawtooth oak, a tree native to eastern Asia, is popular for use in street tree plantings due to its interesting foliage and fruits (acorns). It spreads by seed that is produced in large numbers and has been found in recent years to be escaping from plantings to become invasive in wild areas, displacing native plants. Because of this, land managers recommend against the use of sawtooth oak and suggest instead that landscapers use native oaks, of which there are many species to choose.

Prevention and Control

Do not plant sawtooth oaks. If small, pull seedlings or treat leaves with glyphosate. To control large trees: cut tree and grind stump; girdle, hack and squirt glyphosate; or cut and paint stump with glyphosate.

Native Alternatives

shagbark hickory (*Carya ovata*), American beech (*Fagus grandifolia*), green ash (*Fraxinus pennsylvanica*), red oak (*Quercus rubra*)

White Mulberry

Morus alba



Britt Slattery, USFWS

White mulberry, a native of eastern Asia, was introduced during colonial times in an effort to establish a silkworm industry in the United States. It occurs throughout the country with the exception of Arizona and Nevada. The ecological threats posed by white mulberry include its hybridization with and replacement of our native red mulberry (*Morus rubra*), the transmittal of a harmful root disease to red mulberry, and its ability to invade natural areas including fields, forest edges and roadsides.

Prevention and Control

Seedlings can be pulled. Otherwise, cut the tree and grind the stump or cut and paint the stump with glyphosate; if very large, girdle the tree.

Native Alternatives

red maple (*Acer rubrum*), hackberry (*Celtis occidentalis*), black gum (*Nyssa sylvatica*), sassafras (*Sassafras albidum*)

Vines

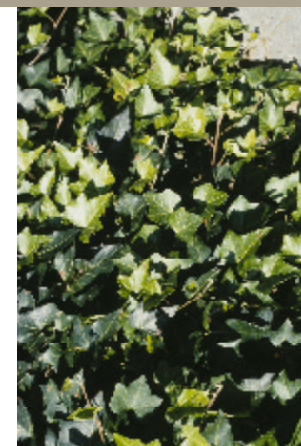
English Ivy

Hedera helix

Origin: Europe, Western Asia and Northern Africa

Background

European immigrants likely introduced English ivy to the United States. It is extremely popular and widely planted because of its evergreen foliage and dependability as a year-round ground cover. Although widely recognized as a serious pest of natural areas, it continues to be sold as an ornamental plant in the United States.



USDA, NRCS

Distribution and Ecological Threat

English ivy occurs throughout the eastern United States, across the southern states and up to Washington State. It is one of the most abundant and insidious invasive plants, as it threatens all vegetation levels of forested and open areas, growing along the ground as well as into the tree canopy. English ivy infests woodlands, forest edges, fields, hedgerows, coastal areas, salt marsh edges and other upland areas, especially where some soil moisture is present. As a ground cover, the dense growth and abundant leaves form a thick canopy just above the ground that prevents sunlight from reaching herbs and seedlings. Vines that climb up trees slowly kill the tree from the base upwards by enveloping branches and twigs, blocking sunlight, causing branch and eventual tree death. The added weight of vines also makes trees susceptible to blowing over during storms. English ivy has been confirmed as a reservoir for bacterial leaf scorch (*Xylella fastidiosa*), a harmful plant pathogen that affects a wide variety of native and ornamental trees such as elms, oaks and maples.

Description and Biology

- **Plant:** an evergreen climbing vine in the ginseng family (Araliaceae). Vines attach to the bark of trees and other surfaces by way of numerous, small, root-like structures, which exude a glue-like substance; older vines can reach a foot in diameter.
- **Leaves:** dark green, waxy, somewhat leathery, arranged alternately along the stem; leaf forms are extremely variable with the most recognized leaf form being three-lobed.
- **Flowers, fruits and seeds:** when sufficient light is available, umbrella-like clusters of small, greenish-white flowers are produced in the fall

on flowering branches that extend out at right angles from clinging vines; fruits are black with a fleshy outer layer and mature during the following spring; seeds are stone-like.

- Spreads: reproduces vegetatively and by seed, which is dispersed to new areas primarily by birds. English ivy contains glycosides that cause some birds to vomit and disseminate seeds. New plants grow easily from cuttings or stem fragments that make contact with the soil.
- Look-alikes: Boston ivy (*Parthenocissus japonicus*) is sometimes confused with English ivy.

Prevention and Control

Do not plant English ivy. Vines on the ground can be pulled up by hand, with some difficulty and bagged and disposed of as trash. Vines climbing up trees should be cut to kill upper portions and relieve the tree canopy. Portions of vines rooted in the ground will remain alive and will need to be treated with herbicide or cut repeatedly until no re-growth occurs. A systemic herbicide like triclopyr may be applied to foliage or cut stems. There are no biological controls currently available for English ivy.

Native Alternatives

Vines:

Virginia creeper
(*Parthenocissus quinquefolia*)



Britt Slattery, USFWS

crossvine
(*Bignonia capreolata*)



Britt Slattery, USFWS

Groundcovers (use alone or mix for diversity and sustainability):

wild ginger
(*Asarum canadense*)



Britt Slattery, USFWS

lady fern
(*Athyrium filix-femina*)



Kenneth J. Sytsma, UWI

foam flower
(*Tiarella cordifolia*)



Britt Slattery, USFWS

evergreen wood fern
(*Dryopteris marginalis* or *intermedia*)



Emmet J. Judziewicz, UWI

partridgeberry
(*Mitchella repens*)



Britt Slattery, USFWS

creeping phlox
(*Phlox stolonifera*)



Britt Slattery, USFWS

Vines

Kudzu

Pueraria montana

Origin: Asia

Background

Kudzu was introduced into the United States from Japan in 1876 at the Philadelphia Centennial Exposition, where it was promoted as an ornamental and a forage crop plant. From 1935 to the mid-1950s, farmers in the South were encouraged to plant kudzu to reduce soil erosion, and the Civilian Conservation Corps planted it widely for many years. Kudzu nicknamed “the vine that ate the south,” was eventually recognized as a pest weed by the U.S. Department of Agriculture and, in 1953, was removed from its list of permissible cover plants.



David Moorhead

Distribution and Ecological Threat



Kerry Britton

Kudzu is common throughout most of the southeastern United States and in recent years has been found in northern states as well. It is apparently able to withstand harsher winter conditions than previously thought. Kudzu grows well under a wide range of conditions and in many soil types. Preferred habitats are open, sunny areas like forest edges, abandoned fields, roadsides and disturbed areas. Kudzu grows best where winters are mild, summer temperatures are above 80 degrees Fahrenheit and annual rainfall is 40 inches or more. Its vigorous growth and large leaves smother native plants; its vines kill trees through girdling and the added weight of vines can lead to uprooting trees. Once established, kudzu plants grow rapidly, extending as much as 60 feet per season, at the astonishing rate about 1 foot per day.

Description and Biology

- Plant: a climbing perennial vine in the pea family (Fabaceae); vines may extend 32 to 100 feet in length, with stems up to 4 inches in diameter. Roots are fleshy, with massive tap roots 7 inches or more in diameter, 6 feet or more in length, and weigh as much as 400 pounds; 30 vines may grow from a single root crown.

- **Leaves:** deciduous leaves are compound, with three broad leaflets up to 4 inches across; leaves alternate along stem; leaflets may be entire or lobed with hairy margins.
- **Flowers, fruits and seeds:** individual flowers, about 1/2 inch long, are purple, fragrant and borne in upright clusters during late summer. Fruits if present are brown, hairy, flattened seed pods, each of which may contain up to ten hard seeds.
- **Spreads:** mainly vegetative through expansion by runners and rhizomes and by vines that root at the nodes to form new plants; may spread by seeds in areas where a pollinator, the giant resin bee, occurs.

Prevention and Control

For successful long-term control of kudzu, the extensive root system must be destroyed. Any remaining root crowns can lead to reinfestation of an area. Mechanical methods include cutting vines just above ground level, frequent mowing and cultivation. Use of systemic herbicides is the most effective and practical method currently employed. The federal government is investigating biological control agents for kudzu.

Native Alternatives

After eradicating, plant area with native vegetation appropriate to site conditions. Refer to References on pages 76-78.



Jil Swearingen, NPS



David J. Moorehead

Vines

Mile-a-minute

Polygonum perfoliatum

Origin: India, Eastern Asia and the islands from Japan to the Philippines

Background

Mile-a-minute, also called Devil's tear-thumb, was experimentally introduced into Portland, Oregon in 1890, and later to Beltsville, Maryland in 1937 but did not become established at either site. An additional unintentional introduction in the 1930s to a nursery site in York County, Pennsylvania was successful and is the likely source of this invasive plant in the mid-Atlantic and northeastern United States. Seeds of the plant may have been spread with rhododendron stock.

Distribution and Ecological Threat

Mile-a-minute weed is found in the northeast from Virginia to New York to Ohio and Oregon. It invades open and disturbed areas, such as fields, forest edges, stream banks, wetlands, roadsides and wetlands. Mile-a-minute grows rapidly, scrambling over existing plants, limiting their photosynthesis, which can lead to their death.

Description and Biology

- **Plant:** an herbaceous, annual, trailing vine in the buckwheat family (Polygonaceae); delicate stems are reddish and armed with downward pointing hooks or barbs; stems are surrounded by distinctive circular, funnel-shaped leafy structures, called ocreae.
- **Leaves:** light green and shaped like equilateral (equal-sided) triangles with barbs on the undersurface; alternate along the stems.
- **Flowers, fruits and seeds:** flower buds, and later flowers and fruits, emerge from within the ocreae; flowers are small, white and inconspicuous; fruits are attractive, metallic blue and segmented, each segment containing a single glossy, black or reddish-black seed.
- **Spreads:** birds are likely the primary long-distance dispersal agents of mile-a-minute weed; transport of seeds short distances by native ant species has been observed; water is also an important mode of



Britt Slattery, USFWS

dispersal as fruits can remain buoyant for seven to nine days.

Prevention and Control

Manual and chemical methods are effective for controlling mile-a-minute. Seedlings and vines are easy to pull by hand as long as gloves and sturdy clothing are worn. However, pulling vines with mature fruits should be avoided as it may help spread seeds. Contact and systemic herbicides are effective in controlling it. Because the foliage has a waxy covering, the herbicide must be mixed with surfactant to help it adhere to the plant.

Native Alternatives

After eradicating, plant area with native vegetation appropriate to site conditions. Refer to References on pages 76-78.



USDA, NRCS

People use **English ivy** (*Hedera helix*) to cover difficult sites, but it rapidly spreads beyond property boundaries, choking the forest floor and slowly killing trees.



Joseph D. Ruffner, USDA, NRCS

Japanese honeysuckle (*Lonicera japonica*), (left and lower left), grows vigorously and is known for taking over woodlands.



Britt Slattery, USFWS

Creeping Euonymus (*Euonymus fortunei*) invades the woodland floor where it crowds out native plants.



Jill Swearingen, NPS

Vines

Oriental Bittersweet

Celastrus orbiculatus

Origin Eastern Asia, Korea, China and Japan

Background

Oriental bittersweet was introduced into the United States in the 1860s as an ornamental plant and it is still widely sold for landscaping despite its invasive qualities. It is often associated with old home sites, from which it has escaped into surrounding natural areas.



James H. Miller

Distribution and Ecological Threat

Oriental bittersweet occurs from New York to North Carolina, westward to Illinois. It infests forest edges, open woodlands, fields, hedgerows, coastal areas, salt marsh edges and particularly disturbed lands. While often found in more open, sunny sites, its shade tolerance allows it to invade forested areas. Oriental



James H. Miller



James H. Miller

bittersweet is an aggressive invader that threatens vegetation at all heights in forested and open areas. It grows over other vegetation, completely covering and killing other plants by preventing photosynthesis, by girdling, and by uprooting trees through excessive weight. In the Northeast, Oriental bittersweet appears to be displacing the native climbing bittersweet, *Celastrus scandens*, through competition and hybridization.

Description and Biology

- **Plant:** a deciduous, woody, twining vine in the staff-tree family (Celastraceae), which sometimes occurs as a trailing shrub. Stems of older plants sometimes grow to four inches in diameter.
- **Leaves:** glossy, rounded, finely toothed and arranged alternately along the stem.
- **Flowers, fruits and seeds:** abundant clusters of small greenish flowers emerge from most leaf axils; globular, green to yellow fruits split open

at maturity to reveal three red-orange, fleshy arils that surround the seeds; seeds germinate in late spring.

- **Spreads:** Oriental bittersweet spreads by seed, which is dispersed to new areas by many species of birds. People also spread seed widely when using the plant for wreaths and ornamental arrangements. It also expands vegetatively by stolons and rhizomes, and through root suckering (the ability to send shoots up from the roots).
- **Look-alikes:** This plant is easily confused with our native climbing bittersweet vine (*Celastrus scandens*), which flowers at the stem tips rather in the leaf axils, it is imperative that correct identification be made before controls are attempted.

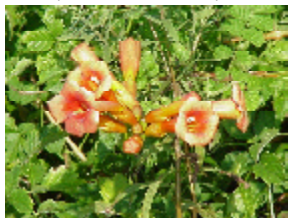
Prevention and Control

Manual, mechanical and chemical methods can be employed to control bittersweet. Vines can be pulled out by the roots, cut repeatedly or treated with systemic herbicides. No biological controls are currently known for oriental bittersweet.

Native Alternatives

Note: Although our native bittersweet (*Celastrus scandens*) is an excellent alternative plant to use, many nurseries confuse it with the exotic invasive Oriental bittersweet. Be certain of the species you are buying or choose another plant. Other options include:

trumpet creeper
(*Campsis radicans*)



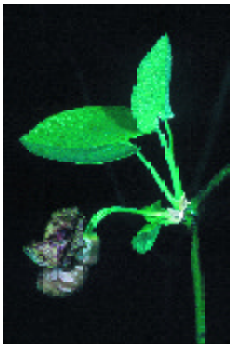
Britt Slattery, USFWS

trumpet honeysuckle
(*Lonicera sempervirens*)



Britt Slattery, USFWS

pipevine
(*Aristolochia macrophylla*)



R. Harrison Wiegand

passionflower
(*Passiflora incarnata*)



R. Harrison Wiegand

Vines

Porcelainberry

Amelopsis brevipedunculata

Origin: China, Korea, Japan and the Russia

Background

Porcelainberry was originally cultivated as a bedding and landscape plant. In spite of its aggressiveness in some areas, it is still widely used and promoted in the horticultural trade.

Distribution and Ecological Threat

Porcelainberry occurs from New England to North Carolina and west to Michigan. It grows well in most soils, especially in pond margins, streambanks, thickets and waste places, where there is full sunlight to partial shade, and where it is not permanently wet. This



Jil Swearingen, NPS



Jil Swearingen, NPS

climbing vine shades out native shrubs and young trees. Porcelainberry grows and spreads quickly in open areas of the urban landscape. The seeds of porcelainberry germinate readily in the soil after natural or human disturbance.

Description and Biology

- **Plant:** a deciduous, woody, perennial vine of the grape family (Vitaceae); climbs by tendrils that grow opposite the leaves on the stem; vines grow to heights of 15 to 20 feet.
- **Leaves:** simple, heart-shaped, and dark green with coarsely toothed edges; shiny underneath with delicate hairs along the veins; vary from slightly lobed to deeply dissected; arranged alternately along the stem.
- **Flowers, fruits and seeds:** small, greenish-white flowers appear in clusters in summer. The berries appear in the fall, ranging in color from white to yellow, to shades of green, lilac, purple, turquoise and

sky blue. Each ¼ inch berry carries two to four seeds.

- Spreads: birds and other small animals eat the berries and disperse the seeds in their droppings.
- Look-alikes: native grape (*Vitis*) species and several native species of *Ampelopsis*.

Prevention and Control

Mechanical and chemical methods have been used successfully to control porcelainberry infestations. Hand pruning in the fall or spring will prevent flower buds from forming the following season. Vines on trees can be cut to prevent seed formation and further damage to trees. Systemic herbicides are also effective.

Native Alternatives

virgin's bower
(*Clematis virginiana*)



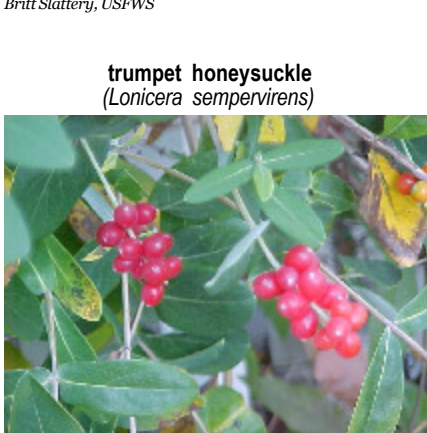
Britt Slattery, USFWS

trumpet creeper
(*Campsis radicans*)



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trumpet honeysuckle
(*Lonicera sempervirens*)



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Vines

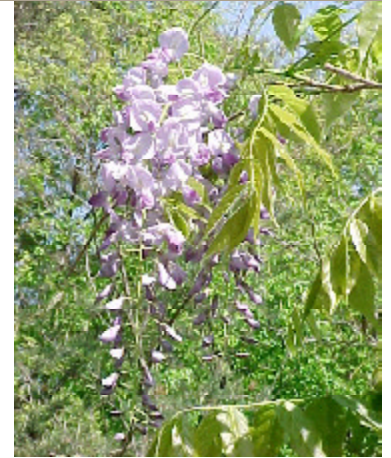
Exotic Wisterias

Chinese (*Wisteria sinensis*) and Japanese (*Wisteria floribunda*)

Origin: China (Chinese wisteria) and Japan (Japanese wisteria)

Background

These exotic ornamental wisterias were brought into the United States around 1830. They have been grown extensively in the south and mid-Atlantic and adorn many porches,



Britt Slattery, USFWS

gazebos, walls gardens and parks. Most infestations in natural areas are a result of escapes from landscape plantings.

Distribution and Ecological Threat

Exotic wisterias displace native herbs, vines, shrubs and trees through shading and girdling. Climbing wisteria vines can kill sizable trees, opening the forest canopy and increasing sunlight to the forest floor, which favors the growth of its numerous seedlings.



Britt Slattery, USFWS

Description and Biology

- **Plant:** showy, woody, ornamental vines in the pea family (Fabaceae). These vigorous vines can climb trees, apparently limited only by the height of the tree, and have been observed at 65 feet in the canopy. Stems of older plants can grow to 15 inches in diameter. Chinese wisteria vines twine counter-clockwise around the host plant and white-barked Japanese wisteria vines twine clockwise.
- **Leaves:** compound leaves of both species are about 1 foot in length and alternate along the stem. Chinese wisteria leaves consist of 7 to 13 leaflets; Japanese has 13 to 19 leaflets.
- **Flowers, fruits and seeds:** fragrant, violet to blue-violet flowers, ½ to 1 inch long, occur in pendulous clusters that hang from twining stems. Flowering occurs in spring (April-May); fruits are velvety brown seed pods, 4 to 6 inches long, narrowed toward the base, with constrictions in the pods that separate the seeds. American wisteria (*Wisteria frutescens*), a native to the southeastern U.S., flowers in summer and produces a non-hairy seed pod 2 to 4 inches long.

- Spreads: by seed under favorable conditions and by producing stolons (aboveground stems) that develop roots and shoots at short intervals. Seeds can be carried great distances downstream in water.
- Look-alikes: American wisteria (*Wisteria frutescens*), trumpet creeper (*Campsis radicans*).

Prevention and Control

Cutting can be employed for small infestations, or to relieve trees of the weight and damage caused by large twining vines. Use of systemic herbicides (e.g. triclopyr) is probably a more effective method for larger, established infestations.

Native Alternatives



R. Harrison Wiegand

pipevine
(*Aristolochia macrophylla*)



Britt Slattery, USFWS

crossvine
(*Bignonia capreolata*)



Britt Slattery, USFWS

trumpet honeysuckle
(*Lonicera sempervirens*)



Fred Nation



Britt Slattery, USFWS

Creeping Euonymus

Euonymus fortunei



James H. Miller

Creeping euonymus, or winter creeper, is an evergreen perennial vine in the bittersweet family (Celastraceae) that was introduced from China as an ornamental groundcover. It tolerates a variety of environmental conditions including full sun to deep shade, poor soils, and acidic to basic soils and is found in about 20 states in the eastern United States. Natural forest openings, caused by wind, insects or fire, are especially vulnerable to invasion by this plant. Creeping euonymus climbs trees and other vertical surfaces and grows vigorously across the ground, displacing native plants and appropriating soil, moisture, nutrients, sunlight and space that would otherwise be available to native species. It spreads vegetatively and by seed that is dispersed by wildlife and water.

Prevention and Control

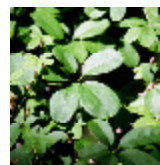
A variety of mechanical and chemical methods are available for management of climbing euonymus, including hand pulling, cutting and application of systemic herbicides.

Native Alternatives

pipevine (*Aristolochia macrophylla*), crossvine (*Bignonia capreolata*), trumpet honeysuckle (*Lonicera sempervirens*), American wisteria (*Wisteria frutescens*)

Fiveleaf Akebia

Akebia quinata



Jill Swearingen, NPS

Fiveleaf akebia, or chocolate vine, is an unusual and attractive exotic vine in the Lardizabala family (Lardizabalaceae) that was imported from Asia around 1845 for ornamental purposes. A deciduous, perennial vine, it occurs in about twenty states in the eastern United States, from Louisiana to Massachusetts and west to Michigan. Where it has become established, it can grow rapidly, forming an impenetrable groundcover, climbing trees and shrubs and smothering everything in its path. Akebia is spread by seed and by vegetative means.

Prevention and Control

Young plants can be pulled by hand. Cutting can be done any time of year and vines should be cut to the ground. Akebia vines may also be dug up, removing as much of the roots as possible. For large infestations, apply a systemic herbicide.

Native Alternatives

pipevine (*Aristolochia macrophylla*), cross vine (*Bignonia capreolata*), trumpet creeper (*Campsis radicans*), trumpet honeysuckle (*Lonicera sempervirens*)

Japanese Honeysuckle

Lonicera japonica



J.D. Ruffner, USDA

Japanese honeysuckle is a perennial vine that was introduced from eastern Asia during the 1800's as an ornamental, for erosion control and for wildlife cover and food. Japanese honeysuckle is extremely widespread, occurring in at least 38 states from California across southern and midwestern states to New England and the Great Lakes region. It escaped cultivation to invade cultivated and natural areas where it grows vigorously, smothering most vegetation in its path, and girdles shrubs and young trees as it twines up to reach greater light. Its evergreen nature gives it an additional advantage, allowing it to grow when most other plants are dormant. Japanese honeysuckle is a vigorous bloomer and produces abundant seed dispersed by birds.

Prevention and Control

Small populations can be controlled by hand removal of trailing vines. Over large areas, mowing twice a year can slow vegetative spread, however due to re-sprouting, stem density may increase. Japanese honeysuckle can be treated with glyphosate herbicide. Reapplication may be necessary.

Native Alternatives

Vines: crossvine (*Bignoniacapreolata*), trumpet creeper (*Campsisradicans*), trumpet or coral honeysuckle (*Lonicera sempervirens*)

Plants for fragrance: sweetpepperbush (*Clethra alnifolia*), sweetbay magnolia (*Magnolia virginiana*)

Louis' Swallowwort

Cynanchum louiseae

Louis' swallowwort is native to Europe, and may have been introduced intentionally for ornamental purposes or imported unintentionally on other plants



Kitty Kohout, UWI

or materials. Louis' swallowwort occurs in the northeastern and mid-Atlantic states to the Midwest, and in California, where it threatens native flora in fields, forest edges, woods and open disturbed areas. It grows vigorously and densely, blocking light from reaching the plants it scrambles across, often leading to their death. Swallowwort spreads vegetatively and by seeds dispersed by the wind. Because there are many native milkweed species in the United States, correct identification of this plant is imperative.

Prevention and Control

Do not plant this or other exotic swallowworts. Plants can be pulled by hand or mowed, once or twice per season, or dug up, removing the entire crown. Picking of pods is used as a last resort to help prevent production and spread of seeds. Application of systemic herbicides like glyphosate and triclopyr is also effective.

Native Alternatives

pipevine (*Aristolochia macrophylla*), swamp milkweed (*Asclepiasincarnata*), butterflyweed (*Asclepiastuberosa*)

Vines

Periwinkle

Vinca minor



Jill Swearingen, NPS

Common periwinkle is a vine or subshrub in the dogbane family (Apocynaceae) that is native to Europe and was introduced for ornamental purposes many decades ago. It occurs throughout the United States in at least 36 states, has escaped cultivation and is invading natural areas. Common periwinkle

poses a threat to native plants and communities because it grows vigorously, forming a dense monotypic evergreen groundcover that displaces and excludes most other plants, including native wildflowers. It spreads by vegetative means only. Flower color can be blue, lilac or white. Several close relatives of this plant, including bigleaf periwinkle (*Vinca major*), imported from Europe, and Madagascar periwinkle (*Catharanthus roseus*), native only to Madagascar, are also invasive in natural areas in the mid-Atlantic and other regions of the United States and the world.

Prevention and Control

Periwinkle can be removed by digging, raising the runners with a rake, and mowing the plants. All of the plant must be removed. It can also be controlled by cutting the plants in the spring followed by applying a glyphosate herbicide to the regrowth.

Native Alternatives

Vines:

crossvine (*Bignonia capreolata*), Virginia creeper (*Parthenocissus quinquefolia*)

Groundcovers (use alone or mix for diversity and sustainability):

wild ginger (*Asarum canadense*), lady fern (*Athyrium filix-femina*), evergreen wood fern (*Dryopteris marginalis* or *intermedia*), partridgeberry (*Mitchella repens*), creeping phlox (*Phlox stolonifera*), New York fern (*Thelypteris noveboracensis*), foam flower (*Tiarella cordifolia*)



Michael Clayton, UWI

Glossary

alien, exotic, foreign, introduced: see non-native.

axil: the junction of leaf and stem.

biodiversity: the sum of all the plants, animals and other organisms living on Earth.

biological control: the use of living organisms—parasites, pathogens or predators—to control an invasive or other pest species.

cultivar: a race or variety of a plant that has been created or selected intentionally and maintained through cultivation.

girdle: to cut through the bark and growing layer (cambium) all around the trunk of a tree.

glyphosate: a type of systemic herbicide, e.g., Roundup® for land or Rodeo® for wetlands or near water.

indigenous: see native.

invasive: a species that grows and spreads rapidly, establishes over large areas, and displaces native species.

native: a species that naturally occurs in a particular region, ecosystem and habitat. Species native to North America are generally recognized as those occurring on the continent prior to European settlement.

natural area: an area of land or water with predominantly native vegetation or natural geological features that is allowed to respond to the forces of nature with minimal human influence.

non-native: a species that, due to direct or indirect human activity, occurs in locations beyond its known

historical or potential natural range. Refers to species from another continent, region, ecosystem, or habitat.

noxious weed: a legal designation used specifically for species that have been determined to be major pests of agricultural systems and are subject, by law, to certain restrictions.

pest: a plant, animal or other organism considered harmful.

rhizomes: underground stems.

sepals: bract-like or leaf-like structures below the petals of a flower.

stipules: a pair of leaf-like structures at the base of the leaf stalk on some plants.

stolons: aboveground stems.

systemic herbicide: an herbicide that is absorbed by a plant and carried throughout the tissues.

turions: vegetative buds formed in leaf axils or stem tips.

triclopyr: a type of systemic herbicide (e.g., Garlon®).

weed: a subjective word used to describe any plant growing wherever someone wishes it did not; can include native and non-native plants.

wildland: see natural area.

**Note: mention of a trade name does not constitute the endorsement of the product by authors, agencies or organizations involved in the production of this publication.*

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National Biological Information Infrastructure and the National Invasive Species Council, www.invasivespecies.gov

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Nonindigenous Aquatic Species Information Resource, <http://nas.er.usgs.gov/>

Pennsylvania Department of Conservation and Natural Resources, www.dcnr.state.pa.us

Pennsylvania Flora Project, www.upenn.edu/paflora

Plant Conservation Alliance, Alien Plant Working Group, "Weeds Gone Wild" <http://www.nps.gov/plants/alien> or <http://www.weedsgonewild.org>

The Nature Conservancy, www.tnc.org or <http://nature.org>

The Nature Conservancy Wildland Invasive Species Program, <http://tncweeds.ucdavis.edu/>

U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, www.aphis.usda.gov/ppq/weeds/

U.S. Fish and Wildlife Service, BayScapes, <http://www.fws.gov/r5cbfo/>

U.S. Geological Survey, Florida Caribbean Science Center, Non-indigenous Aquatic Species Program, http://www.fcsc.usgs.gov/Nonindigenous_Species/nonindigenous_species.html

U.S. Geological Survey Non-indigenous Aquatic Species database, Hydrologic Unit <http://nas.er.usgs.gov/bin/nas/plantshuc2>

U.S. National Park Service, A Strategic Plan for Managing Invasive Plants on National Park System Lands, www1.nature.nps.gov/wv/strat_pl.htm

Virginia Department of Conservation and Recreation, www.dcr.state.va.us

Virginia Native Plant Society, www.vnps.org

West Virginia Division of Natural Resources, www.dnr.state.wv.us

West Virginia Native Plant Society, P.O. Box 75403 Charleston WV 25373-0403, (304) 293-4797 ext. 2493

Legislation Relating to Invasive Species

Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990

National Invasive Species Act of 1996

Executive Order on Invasive Species (E.O. 13112; February 3, 1999)

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Invasive.org, Invasive and Exotic Species of North America. Images downloaded with permission from <http://www.invasive.org/>, September 2002, image numbers listed below. Images are copyrighted by the University of Georgia and by photographers:

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